CONFIDENTIAL

Issued: October 12, 1961
Revised: March 9, 1962

DATA PLATE INFORMATION AND TEST INSTRUCTION SHEET

25 YEAR RE-REVIEW

For Use By Pratt & Whitney Aircraft Personnel Only

JT11 TURBOJET ENGINE

Engine Model	Sales Order
YJT11D-20A	CTJ-86207 CTJ-86160 CTJ-86384

DATA PLATE INFORMATION

Data Plate Drawing No. 154093

1. TEST INFORMATION

Ratings: (At standard sea level static conditions)

	Jet Thrust lbs	Speed RPM	TSFC lbs/hr Lb Thrust (max)
Maximum Afterburning	28,000	6600	2.35*YD-1 through YD-3 inclusive
	30,000	6600	2.30*YD-4 and up
Idle	*******	3440 min	****

*Note: This value reflects the HV of PWA 523 fuel with 3% PWA 504 oil.

Maximum Safe Operating Speed

7400 RPM — Engineering should be notified if this value is exceeded.

Weight not to exceed: 6550 lbs (Prior to Engine No. 7)
6060 lbs (Engine No. 7 and up)
(not including remote and reduction gearboxes, shafts and mounts, combination check and dump valve and windmill bypass valve, air frame brackets, supports, ducts)

Fuel Control Units: Engine: Hamilton Standard JFC-47
A/B: Hamilton Standard JFC-51

Fuel: PWA 523B with 3.0 ± 0.1 percent of PWA 504 oil. Oils can be used which meet the PWA 504 specification and that have been approved by Engineering as having demonstrated by test that the thermal stability requirement of the fuel specification can be met with the PWA 523B fuel with 3.0 percent PWA 504 added.

Lubricating Oil: PWA 524

Preservation of engine must be in accordance with Eng. Inst. No. 122.

2. LIMITS FOR TEST

2.1 Fuel System

Main fuel pump inlet pressure:	5 - 50 psig
Afterburner fuel pump inlet pressure:	5 - 50 psig
Hydraulic pump inlet pressure:	90 psig Min @ 6500 RPM 75 psig Min @ 3500 RPM
Hydraulic pump discharge pressure:	2900 ± 100 psig

2.2 Oil System

Main oil pressure:	45-50 psig at idle and above
Inlet temperature:	A maximum temperature of 250°F must not be exceeded without Engineering approval.
Consumption:	Not to exceed .50 gal/hr average during acceptance test.

2.3 Maximum Observed Turbine Inlet Temperature

	Avg. of 9 Thermocouples
Maximum afterburning	1940°F
Military	1940°F
During Starts (See para. 3.9.1)	1200°F

3. TEST PROCEDURE

The requirements of MIL-E-5010B are applicable except where modified below. It should be noted that all engine operating conditions are established by the single power lever having the following schedule: Off (0° to 2°), Start and Idle (13° and 15°), Military (60° to 65°), and Afterburning (66° to 120°). Any special checks listed below which are not included in the Initial and Final Acceptance Tests shall be performed during the Running-in prior to Initial and Final Acceptance Tests, unless otherwise noted.

3.1 Belting-in

With the fuel on and power lever in the off position, the engine shall be operated by external power at a speed sufficiently high to insure that the oil system is fully primed and that the oil pump maintains a steady pressure. Check that there is no external oil leaks or fuel leaks.

3.2 Running Prior to Initial Acceptance

3.2.1 The engine shall be instrumented in accordance with paragraph 3.8.

3.2.2 Main oil pump discharge pressure should be set to the pressure given in paragraph 2.2 using the external adjustment.

3.2.3 Start the engine and slowly accelerate to a thrust level above the point where the internal bleed valves close. The speed at which the internal bleed valves close shall be noted on the engine log sheet. This speed shall fall within band "B" of figure 8. Establish that the external bleed valve closes within the limits of figure 13. Slowly decelerate to idle. The external bleed valve shall open within the limits of figure 13. The speed which the internal bleed valves open shall be noted on the engine log sheet. This speed shall fall within band "A" of figure 8. For engines prior to EC 153546 external bleed valve operation shall fall within the limits of figure 13 A.

3.2.4 Maximum and Idle Trim

3.2.4.1 Green Run Trim

Trim the engine fuel flow so that with the power lever between 63° and 65°, the stabilized corrected thrust falls within band "C" of figure 1. Speed must fall within the band of figure 2. Do not exceed the turbine inlet temperature specified in Paragraph 2.3. The control is to be trimmed using the manual adjustment. Fuel flow must not be adjusted more than 5 ratio units ($^{W}f/Pb$) or 1 1/4 turns of the adjusting screw using the manual adjustment. If, after making max. allowable adjustment, the thrust level is lower than band "C" of figure 1, notify engineering. If, after making max. allowable adjustment, the power lever cannot be advanced to 63° without exceeding the turbine inlet limit, notify engineering, install burner pressure bleed system per figure 15 and continue test.
NOTE: REMOTE TRIMMER MUST NOT BE USED.

3.2.4.2 With the power lever between 13° and 15°, adjust the idle trimmer to obtain a rotor speed within the limits shown on figure 5.

3. 2. 4. 3 Advance power lever to 63° to 65° position. Speed and thrust must be within limits given in paragraph 3. 2. 4. 1. If they are not, repeat paragraph 3. 2. 4. 1 and 3. 2. 4. 2 until speed and thrust requirements are met.

3. 2. 4. 4 With the power lever at the 120° position adjust the A/B control setting so that the corrected thrust falls within the required band "D" on figure 1 and the corrected TSFC does not exceed the maximum limits of figure 4, maintaining engine speed within the limits of figure 2. Observe paragraph 3. 9. 5.

3. 3 Initial Acceptance Test

3. 3. 1 The engine shall be instrumented in accordance with para. 3. 8.

3. 3. 2 The engine shall be subjected to a complete starting cycle as specified in paragraph 3. 9. 1 unless a complete normal start subsequent to trimming the engine has been accomplished during the running-in preceding the test.

3. 3. 3 Fifteen (15) minutes at the thrust meter reading shown by the 65% military thrust band "A" of figure 1. Record all data. 15

3. 3. 4 Twenty(20) minutes at the thrust meter reading shown by the 90% military thrust band "B" of figure 1. Record all data approximately every 10 minutes. A check of the dual junction turbine inlet gas temperature measurement system shall be made during this twenty (20) minute run. Readings from the individual reading thermocouple circuits shall be taken and an arithmetic average computed. The average should be within ± 15°F of the reading taken with the averaging harness. 20

3. 3. 5 Ten (10) minutes with the power lever in the military position. Record all data. The corrected thrust should fall within band "C" of figure 1. 10

3. 3. 6 Twenty (20) minutes consisting of two cycles of five (5) minutes each with the power lever in the idle position and five (5) minutes with the power lever in the military position. 20

3. 3. 7 Fifteen (15) minutes consisting of three (3) periods of five (5) minutes each with the power lever in the military thrust position, in the maximum thrust position and in the military thrust position. Record all data. The corrected maximum thrust must fall within band "D" on figure 1, and corrected TSFC must not exceed the curve on figure 4. 15

3.3.8 Ten (10) minutes consisting of two (2) minutes at each of the power lever positions which produce the following percentages of augmented thrust (the difference between maximum and minimum augmentation provided); 80, 60, 40, 20, and minimum augmentation. Thrust must fall between bands as shown on figure 6. 10

3.3.9 Five (5) minutes with the power lever in the military thrust position. 5

3.3.10 Run for five (5) minutes with the power lever in the idle position. 5

3.3.11 The oil consumption in gallons per hour will be determined per paragraph 3.9.6 and recorded on the engine log sheet.

3.3.12 Drain Leakage Check of Fuel System Components

100
1hr. 40m

During the initial acceptance test, overboard drain leakage from the following components shall be collected:

Main Fuel Pump
Main Fuel Control
C & D Valve *
Exhaust Nozzle Control
A/B Fuel Control
A/B Fuel Pump
Hydraulic Pump
A/B Nozzle Actuators
Compressor Bleed Valve Actuators
Bleed System Pilot Valves

The leakage from each of these components shall be recorded on the engine log sheet.

*To be collected while engine is running. This leakage does not include the leakage during starting or drainage at shutdown.

3.3.13 Upon completion of initial test, the chemical ignition system must be emptied and purged according to Engineering Instruction 129.

3.4 Disassembly and Inspection

Upon completion of the Initial Acceptance Test, the engine shall be removed from the test stand for inspection. After satisfactory completion of inspection, the engine shall be reassembled and prepared for the Final Acceptance Test.

3.5 Belting-In

With the fuel on and power lever in the off position, the engine shall be operated by external power at a speed sufficiently high to insure that the oil system is fully primed and that the oil pump maintains a steady pressure. Check that there are no external oil leaks or fuel leaks.

3.6 Running Prior to Final Acceptance Test

3.6.1 The engine shall be instrumented in accordance with para. 3.8.

3.6.2 Main oil pump discharge pressure should be set to the pressure given in paragraph 2.2 using the external adjustment.

3.6.3 Ten (10) YJT11D-20A engines will be calibrated in accordance with Engineering Instruction No. 94. If Final Acceptance Test data is obtained concurrently with the data required per E.I. 94 and the stabilization period prior to recording data is per E.I. 94, this data will be applicable in partially fulfilling the requirements of the Engineering Instructions.

3.6.4 Start the engine and slowly accelerate to a thrust level above the point where the internal bleed valves close. The speed at which the internal bleed valves close shall b e noted on the engine log sheet. This speed shall fall within band "B" of figure 8. Establish that the external bleed valve closes within the limits of figure 13. Slowly decelerate to idle. The external bleed valve shall open within the limits of figure 13. The speed at which the internal bleed valves open shall be noted on the engine log sheet. This speed shall fall within band "A" of figure 8. The external bleed valve should be open when the engine is stopped. For engines prior to EC 153546 external bleed operation shall fall within the limits of figure 13A.

3.6.5 Maximum and Idle Trim

3.6.5.1 Trim the engine fuel flow so that with the power lever between 63° and 65°, the stabilized corrected thrust falls within band "C" of figure 1. Speed must fall within the band of figure 2. Do not exceed the turbine inlet temperature specified in para. 2.3. The control is to be trimmed using the manual adjustment only. Do not use remote trimmer to adjust control. Fuel flow must not be adjusted more than 5 ratio units (W_f/P_b or 1 1/4 turns of the adjusting screw). If the control cannot be trimmed so that thrust falls within Band "C", notify Engineering.

3.6.5.2 With the power lever between 13° and 15° adjust the idler trimmer to obtain a rotor speed within the limits shown on fig. 5.

3.6.5.3 Advance power lever to 63° to 65° position. Speed and thrust must be within limits given in para. 3.6.5.1. If they are not, repeat para. 3.6.5.1 and 3.6.5.2 until speed and thrust requirements are met.

3.6.5.4 With the power lever at the 120° position, adjust the A/B control setting so that the corrected thrust falls within the required band "D" on figure 1 and the corrected TSFC does not exceed the maximum limits of figure 4, maintaining engine speed within the limits of figure 2. Observe paragraph 3.9.5.

3.6.5.5 Simulated Tt_2 Test of Main Fuel Control

NOTE: Actual Tt_2 temperature must be + 10°F or higher in order to perform this test.

3.6.5.5.1 Remove the main fuel control sensing bulb from the engine inlet and install cover over sensor hole in the inlet case. Install the sensing bulb in the test apparatus to simulate hot Tt_2 temperatures.

Remove the engine burner pressure line to the main fuel control burner pressure limiters. Install clean test lines in accordance with figure 11 so that engine burner pressure or regulated nitrogen pressure may be supplied to the main fuel control through a suitable selector valve.

Disconnect the linkage between the bypass bleed pilot valve and the main fuel control. Install test apparatus to actuate the bypass bleed pilot valve in response to a manual signal from the control room. Attach an indicator on the main fuel control bypass bleed shaft or link to measure bypass bleed position scheduled by the main fuel control.

3.6.5.5.2 With the simulated Tt2 temperature within 10°F of engine inlet temperature (actual Tt_2), engine burner pressure supplied to the main control, and bypass bleeds scheduled to the bleed open position; start the engine. Slowly accelerate the engine to a speed within the range of 6000 to 6500 rpm manually closing the bypass bleeds in accordance with the limits shown on figure 8 during the slow acceleration.

With engine speed within the range of 6000 to 6500 rpm, set nitrogen pressure (Pn) equal to engine burner pressure and then supply nitrogen pressure to the main fuel control instead of engine burner pressure. The nitrogen pressure supplied to the main fuel control must not exceed 165 psig.

3. 6. 5. 5.3 While maintaining turbine inlet temperature (Tt_4) less than 1800°F and engine speed within the range of 6400 to 6500 rpm (use PLA and/or nitrogen pressure modulation if necessary to maintain Tt_4 and speed limits), increase simulated Tt_2 temperature until bypass bleed open position is scheduled by the main fuel control as shown by the applicable indicator. Simulated T_{t2} temperature shall be increased slowly above approximately 250°F until the bleed opening point is determined.

Limits: The main control shall schedule bypass bleed open position within the limits of 285° to 310°F simulated Tt2 temperature.

3. 6. 5. 5.4 While maintaining Tt_4 less than 1800°F and engine speed less than 7100 rpm (use PLA and/or nitrogen pressure modulation if necessary to maintain Tt_4 and speed limits), increase simulated Tt_2 temperature without overshoot to any constant value ± 5°F within a range of 575° to 625°F.

While maintaining speed less than 7100 and Tt_4 less than 1800°F, by use of nitrogen pressure modulation, increase PLA to military.

Increase nitrogen pressure until constant speed operation is obtained with the exhaust nozzle at 7 1/2* square feet or smaller.

CAUTION: DO NOT EXCEED 7100 RPM OR 1800°F IN SETTING THIS POINT AND DO NOT AFTERBURN.

At the constant speed point and at the end of a five (5) minute stabilization period, record engine speed, main engine fuel flow, and nitrogen pressure (P_n).

Limits: Engine speed shall be within the limits shown on figure 12.

Fuel flow ratio shall be within the limits shown on figure 12.

Fuel flow ratio (W_f/P_b) shall be calculated by dividing fuel flow (W_f) by nitrogen pressure (P_n) in psia units.

*This area to be confirmed by continued engine testing; subsequent changes should be expected.

3.6.5.5.5 While maintaining turbine inlet temperature (T_{t4}) less than 1800°F, and engine speed within the range of 6400 to 6500 rpm (use PLA and/or nitrogen pressure modulation if necessary to maintain T_{t4} and speed limits), decrease simulated T_{t2} temperature from the 575° to 625°F range until bypass bleed closed position is scheduled by the main control as shown by the applicable indicator. Simulated T_{t2} temperature shall be decreased slowly below approximately 350°F until the bleed closing point is determined.

Limits: The main control shall schedule bypass bleed closed position with the limits of 285° to 310°F simulated T_{t2} temperature.

3.6.5.5.6 With engine speed maintained within the range of 6000 to 6500 rpm, decrease simulated T_{t2} temperature to within 10°F of engine inlet temperature (actual T_{t2}).

Set nitrogen pressure (P_n) to equal engine burner pressure (P_b) and then supply engine burner pressure to the main fuel control. Shutoff nitrogen pressure.

Slowly decelerate the engine to idle manually opening the bypass bleeds in accordance with the limits shown on figure 8 during the slow deceleration.

Shut down the engine.

3.6.5.5.7 Disconnect the test equipment and lines that were installed in Section 3.6.5.5.1. Reconnect and install bill of material parts following established assembly procedures.

3.7 Final Acceptance Test

3.7.1 The engine shall be instrumented in accordance with para. 3.8.

3.7.2 The engine shall be subjected to a complete starting cycle as specified in paragraph 3.9.1 unless a complete normal start subsequent to trimming the engine has been accomplished during the running-in preceding the test. The overall time from initiation of fuel system pressurization until idle speed is reached shall be determined and recorded.

3.7.3 Fifteen (15) minutes at the thrust meter reading shown by the 65% military thrust band "A" of figure 1. Record all data.

3.7.4 Twenty (20) minutes at the thrust meter reading shown by the 90% military thrust band "B" of figure 1. Record all data approximately every 10 minutes. A check of the dual junction turbine inlet gas temperature measurement system shall be made during this twenty (20) minute run. Readings from the individual reading thermocouple circuits shall be taken and an arithmetic average computed. The average should be within ± 15°F of the reading taken with the averaging harness.

3.7.5 Ten (10) minutes with the power lever in the military thrust position. The corrected thrust must fall within band "C" of figure 1.

3.7.6 Twenty (20) minutes consisting of two cycles of five (5) minutes with the power lever in the idle position and five (5) minutes with the power lever in the military position.

3.7.7 Fifteen (15) minutes consisting of three (3) periods of five (5) minutes each with the power lever in the military position, in the maximum thrust position, and in the military position, respectively, Record all data. At the maximum thrust position, the corrected TSFC must not exceed the curve on figure 4.

3.7.8 Check the functioning of the afterburner igniter by firing the afterburner three (3) times successively without exceeding 75° power lever position. This should consist of 10 to 15 second afterburner "ON" periods and 10 second afterburner "OFF" periods. Record the power lever angle at which the afterburner cuts off.

3.7.9 Ten (10) minutes consisting of two (2) minutes at each of the power lever positions which produce the following percentage of augmented thrust (the difference between maximum and minimum augmentation provided): 80, 60, 40, 20 and minimum augmentation. Thrust must fall between bands as shown on figure 6.

3.7.10 Five (5) minutes with power lever in military thrust position.

3.7.11 Run for five (5) minutes with the power lever in the idle position.

3.7.12 The oil consumption in gallons per hour will be determined per paragraph 3.9.6 and recorded on the engine log sheet.

3.7.13 Correct and plot Final Acceptance Data. Additional data may be taken if necessary to define standard day sea level performance. All data are to be corrected in accordance with paragraph 3.10.

3.7.14 At sea level standard day military thrust (20,300 lbs YD-1 through YD-3 inclusive, 21,600 lbs YD-4 and up), the engine pressure ratio (P_{T5}/P_{T2}) as established from paragraph 3.7.13 must fall within the limits of 2.47 to 2.53 (YD-1 through YD-3 inclusive) or 2.65 to 2.71 (YD-4 and up).

3.7.15 Drain Leakage Check of Fuel System Components

During the Final Acceptance Test, overboard drain leakage from the components listed below shall be individually collected and recorded. The individual leakage shall not exceed the following limits:

Main Fuel Pump	66 cc/hr
Main Fuel Control	300 cc/hr
C & D Valve	300 cc/hr*
Exhaust Nozzle Control	300 cc/hr
Afterburner Fuel Control	200 cc/hr
Afterburner Fuel Pump	200 cc/hr
Hydraulic Pump	120 cc/hr
A/B Nozzle Actuators	80 cc/hr
Compressor Bleed Actuators	80 cc/hr
Bleed Pilot Valves	10 cc/hr/valve
Total leakage should not exceed	** cc/hr

*To be measured while engine is running. This leakage does not include the leakage during starting or the drainage at shutdown.

**To be supplied at a later date.

3.7.16 At the completion of the Final Acceptance Test, the main fuel pump inlet strainer and hydraulic system filter shall be removed for inspection and cleaning. Results of this inspection shall be noted on the engine log sheets. The reassembly of these strainers and filters shall be leak checked during the preservation cycle.

3.7.17 Upon completion of final test, the chemical ignition system must be emptied and purged according to Engineering Instruction No. 129.

3.8 Instrumentation

3.8.1 Instrumentation for all running shall be:

Variable	Symbol	Number Required	Standard Instrumentation Range Required	Standard Instrumentation Accuracy Required
Thrust	F_n	1	0-60,000 lbs	± 1.0%
Rotor Speed	N	1	0-8000 RPM	± .2%
Fuel Flow - Total	W_f	1	650-75000 pph	± .5%
Fuel Flow - Cooling		1	650-8000 pph	± 2%
Inlet Total Pressure	P_{T_2}	6	14 - 30" Hga	± .5%
Inlet Diff. Pressure	$P_{T_{2_1}} - P_{S_2} = \Delta P$	6	0 - 40" $H_2C_2B_{r2}$	± .5%
Burner Pressure - Main Control	P_{B_1}	1	0 - 200 psig	± .5%
Burner Pressure - A/B Control	P_{B_2}	1	0 - 200 psig	± .5%
Turbine Exhaust Pressure	P_{T_5}	1	14 - 60" Hga	± .5%
Fuel Pump Inlet Pressure - Main		1	0 - 100 psig	
Fuel Pump Inlet Pressure - A/B		1	0 - 100 psig	
Main Oil Pressure		1	0 - 100 psig	
Breather Pressure		1	0 - 15" Hg	
Inlet Temperature	TT_2	1	-20 to +150°F	± .5%
Fuel Inlet Temperature at Flowmeters		2	-20 to +700°F	± .5%
Engine Fuel Inlet Temperature		2	-20 to +700°F	± .5%

Variable	Symbol	Standard Instrumentation Number Required	Range Required	Accuracy Required
Turbine Inlet Temperature (Avg)	T_{T_4}	1	0 to +2400°F	± .5%
Turbine Inlet Temperature (Ind.)	T_{T_4}	9	0 to +2400°F	± .5%
Main Oil Temperature		1	-20 to +700°F	± .5%
Position Indicators				
a. Power Lever		1	0 - 150°	
b. Exhaust Nozzle		1	0 - 100% stroke	
c. Internal bleed valves		1	open - close	
d. External bleed valves		1	open - close	

3.8.2 During all engine runs vibration pickups must be installed on the engine as specified below. Consolidated Engineering Corporation pickups No. CEC 4-118 or CEC 4-123, suitably calibrated and maintained, must be used. Vibration amplitude must be observed during acceleration, deceleration, and steady state running at all speeds. Vibration at each of the locations listed must not exceed 2.0 mils at steady state conditions or 2.5 mils during accelerations and decelerations.

Engine Case	Side of Engine	Flange	Face of Flange	Bolts Used
Inlet	Top Vert.	Rear	Rear	Bolts 2 & 3 CCW From Top
Diffuser	Left Horiz.	Rear	Front	Bolts 3 & 4 Above Horiz.
Turbine Exhaust	Left Horiz.	Middle	Front	Bolts 4 & 5 Above Horiz.
Main Gearbox	Left Horiz.	Main Fuel Pump Pad	Rear	Bolt 1 Below Horiz.

Brackets used to mount vibration pickups must be approved by Project Engineering.

3.8.3 Calibrated flowmeters should be used to measure fuel flow. Air flow measurements, as such, need not be made but the following instrumentation should be installed for all runs and full readings should be taken whenever all data is to be recorded:

Inlet screen	*8 thermocouples connected to give one average temperature
Inlet bellmouth	**6 pitot-static probes

*T_{T2} harness must be checked often enough to insure accuracy.

**At least 4 probes must be reading properly.

3.8.4 The value of thrust during all running where data recordings are required shall be read simultaneously with the reading of the exhaust total pressure probes.

3.8.5 All instruments and equipment will be calibrated often enough to insure that the reported data will have a static accuracy within 2 percent of the value obtained at the maximum rating of the engine, except those instruments called out in paragraph 3.8.1 which shall have the accuracy specified in that paragraph. Data for thrust shall be accurate within 1 percent of the value obtained at the maximum thrust rating of the engine.

3.8.6 When such icing conditions prevail that the inlet pitot static probes ice up and give erroneous or no reading, corrected thrust and fuel flow may be determined by using approximate inlet total pressures obtained from figure 7.

Note: The preceding paragraph is not to be construed as authority to run under conditions which result in icing.

3.8.7 Thrust meter readings taken during the Final Acceptance Test will be corrected for errors introduced by air velocity and pressure gradients in the test cell according to the applicable correction curve for the test cell used.

3.8.8 The specific gravity and temperature of the fuel must be recorded on the log sheet each hour during all tests.

3.9 Specific Requirements for Initial and Final Acceptance Tests

3.9.1 The starting cycle is to be performed as follows:

a. Energize starter
b. Advance power lever to idle position when speed reaches 1000 RPM
c. Allow engine to accelerate to idle speed. Observe maximum turbine inlet temperature.

Note: On every engine start there should be no flaming from the tailpipe or excessively rapid rate of turbine inlet temperature rise.

3.9.2 Changing operating conditions of the engine should be accomplished with a power lever movement of not more than 10° per second. The time consumed in changing from one speed to another shall be credited to the lower speed.

3.9.3 Whenever a shutdown is to be made from power settings of 65% military thrust power or above, the engine should be idled for approximately 5 minutes prior to stopping. If an emergency stop is necessary with less idle time, the rotor should be checked for freedom of rotation just prior to starting.

3.9.4 Trim Procedure

Whenever the controls are to be trimmed, the following procedure should be followed:

3.9.4.1 Turn the appropriate screw adjustments until the various parameters are within the limits of the appropriate curves.

3.9.4.2 Exercise the control by moving the power lever through an angle of approximately 20° three times.

3.9.4.3 Return the power lever to the trim position and allow the engine to stablize for at least 5 minutes. Record all data.

3.9.4.4 The idle and military trimmers may affect each other, therefore, it is necessary to recheck the idle and military trim points using the above procedure until the desired settings are obtained without intermediate adjustment.

3.9.4.5 If the values of speed, military thrust, and maximum thrust recorded at the end of the stabilization period of 3.9.4.3 fall within the limits of the appropriate curves, and the value of PT_5/PT_2 is as described in paragraph 3.7.14, the engine is correctly trimmed.

3.9.5 Afterburning

3.9.5.1 When changing engine operating conditions from afterburner off to afterburner on, the power lever should not be advanced beyond 75° until an afterburner light is assured.

3.9.5.2 The afterburner shall light within 3 seconds after the power lever is advanced beyond 66°.

3.9.5.3 The exhaust nozzle must operate with sufficient speed to prevent supression of engine rotor speed more than 150 RPM when the afterburner is ignited.

3.9.5.4 The exhaust nozzle must close following cessation of afterburning with sufficient speed to prevent an overspeed condition of more than 150 RPM.

3.9.6 The oil consumption in gallon per hour shall be determined in the following manner:

Oil level readings before and after the run shall be preceded by five minutes of oil temperature stabilization at idle. If new oil containing diluent is added prior to the run, the oil level reading must be preceded by ten minutes at an oil temperature out of cooler of 175°F to insure that all diluent is boiled off. The measurement of any oil added during the run must be corrected for any diluent mixed with the oil.

3.9.7 Heatshielding may be installed on the components and tube assemblies after completion of the Final Acceptance Test if this can be accomplished without component removal and without disturbing any tube joints or connections.

3.10 Data Corrections

For both Initial and Final Acceptance Test, the observed data for all calibrations and all points above Idle shall be corrected as shown below:

$$\text{Corrected Thrust} = \frac{(\text{Observed thrust \& cell corr.}) \times 29.92}{\text{Comp. Inlet Press. (In Hg abs)}}$$

$$\text{Corrected Rotor Speed} = \frac{\text{Observed RPM}}{\sqrt{\theta_{t2}}}$$

$$\text{Where } \theta_{t2} = \frac{\text{Compressor Inlet Temp., °F} + 460}{518}$$

$$\text{Corrected TSFC Non Afterburning} = \frac{\text{Observed Fuel Flow (corr. for S.G.)} \times KP^*}{\text{Observed Thrust (+ cell corr.)} \times \sqrt{\theta_{t2}}}$$

$$\text{TSFC Afterburning} = \frac{\text{Observed Fuel Flow (corr. to S.G.)}}{\text{Observed Thrust (+ cell corr.)}}$$

* For values of KP see Figure 14

3.11 Penalty Runs

3.11.1 In case of failure of the engine to meet any of its requirements on test, correction shall be made to overcome the trouble.

3.11.2 When required by the Inspection Department, the engine shall be subjected to a penalty run prior to its final acceptance. If the disassembly affects the oil system or fuel system, the belting-in should be repeated. The standard penalty run shall be the same as the Initial run.

3.11.3 Modification of the penalty run according to the particular circumstances involved will be permitted if considered advisable by the Inspection Department, but in no case shall it be more severe or longer than the initial run.

3.11.4 Parts and components from rejected engines may be used in other engines being build provided the parts and components are not worn or defective to an extent which will prevent their being reconditioned sufficiently to enable them to pass the detailed inspection required for similar unused parts or components. Parts and components from rejected engines shall not be resubmitted for inspection without full particulars being given the inspector concerning previous rejection of the engine.

3.12 Starting Temperatures

The engine shall not experience more than five (5) starts at temperatures exceeding the maximum turbine inlet gas temperature limit for starting, para. 2.3.

4. ASSEMBLY PROCEDURE

4.1. Turbine Nozzle Area

4.1.1 Assemble turbine nozzle vanes to give the areas specified below. Nozzle areas may be determined by the equivalent average class.

	Area, Sq. In.	Average Class
1st	246.3 - 249.0	6.0
2nd	459.9 - 464.2	3.0

A record of the engine numbers must be kept to show when any revision in these areas is effective. When a revision in the specified areas is incorporated, all succeeding engines should be built to the new tolerance.

5. APPENDIXES AND COMPONENT CALIBRATION SCHEDULES

Test of the following engine features and components prior to engine running must be performed in accordance with the Appendixes or Component Calibration Schedules listed below. If there is any subsequent disassembly of the engine parts or components affected by these tests, the test must be repeated following reassembly.

Appendix	A	Compartment Air Checks
"	B	Bench testing of Electrical Cables
"	C	Oil Flow, Bearing and Seal Jets
"	D	Bench Test, Compressor Rear Thrust Bearing
"	E	Bench Test, Remote Gearbox Assembly
"	F	Oil Pump Assembly - Static Air and Oil Leak Check
"	G	Engine and Compressor Air Leakage Check
CCS	J-1	Hydraulic Pump
"	J-2	Hydraulic Filter
"	J-3	Exhaust Nozzle Actuator
"	J-4	A/B Fuel Control
"	J-5	Compressor Bleed Actuator
"	J-6	Fuel Nozzle
"	J-7	Fuel Nozzle Cluster
"	J-8	Compressor Bleed Pilot Valve
"	J-9	Hydraulic Regulator
"	J-10	Chemical Ignition System
"	J-11	Check and Dump Valve
"	J-12	Aft Area Control
"	J-13	CIS-1 Dump Solenoid
"	J-14	Main Fuel Pump
"	J-15	Main Fuel Control
"	J-16	Windmill Bypass Valve
"	J-17	Main F/O Cooler
"	J-18	Main F/O Cooler - Thermo
"	J-19	Main F/O Cooler (Burst Test)
"	J-21	Check, Dump and Windmill Bypass Valve
"	J-22	Exhaust Nozzle Position Indicator
"	J-23	Supp. Bleed Pilot Valve
"	J-24	Remote F/O Cooler
"	J-25	Remote F/O Cooler - Thermo
"	J-26	Remote F/O Cooler (Burst Test)
"	J-35	A/B Fuel Spraybar
"	J-37	Breather Pressurizing Valve

6. APPLICABLE FIGURES

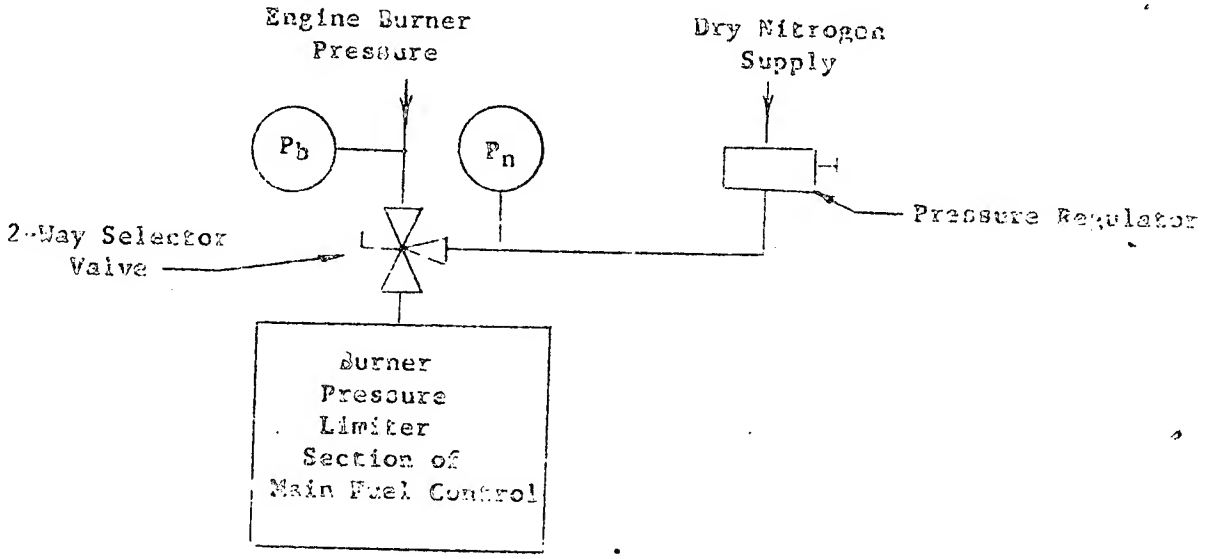
Figure 1	YJT11D-20A	Thrust Curve
" 2	"	Military Rotor Speed
" 3	"	Military Pressure Ratio
" 4	"	Maximum Rated TSFC
" 5	"	Idle Trim Curve
" 6	"	Afterburning Thrust
" 7	"	Compressor Inlet Total Pressure
" 8	"	Internal Bleed Actuation Limits
" 9	"	Military Rotor Speed
" 10	"	Military Rotor Speed
" 11	"	Burner Pressure Sense Schematic Diagram
" 12	"	Fuel Flow Ratio & Engine Speed For Simulated T_{t2} Test
" 13	"	External Bleed Limits (YD-4 and up)
" 13A	"	External Bleed Limits (YD-1 through YD-3 inclusive)
" 14	"	Fuel Flow Correction
" 15	"	

Approved: [redacted]

STAT

SIMULATED T_{T2} TEST OF MAIN FUEL CONTROL

BURNER PRESSURE SENSE SCHEMATIC DIAGRAM



NOTES:

1. Pressure gage ranges and accuracy

   P_b : at least 15 to 200 psia range with ± 5 psi accuracy within this range.

   P_n : at least 50 to 200 psia range with ± 1 psi accuracy within this range.

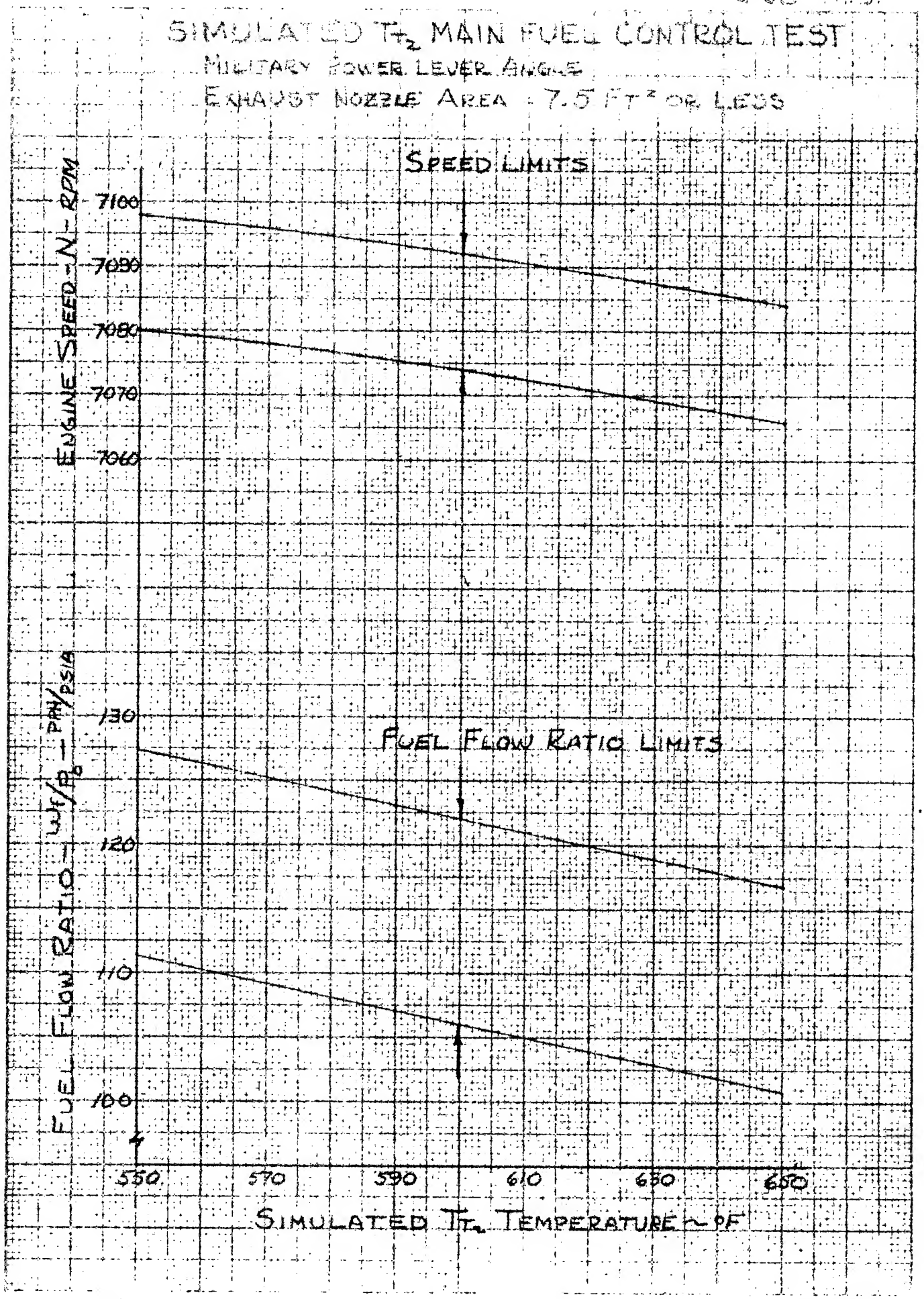
2. All lines shall be clean and not previously used with any liquid.

Approved For Release 2009/07/08 : CIA-RDP67B00657R000100190001-9

SIMULATED T_{t_2} MAIN FUEL CONTROL TEST

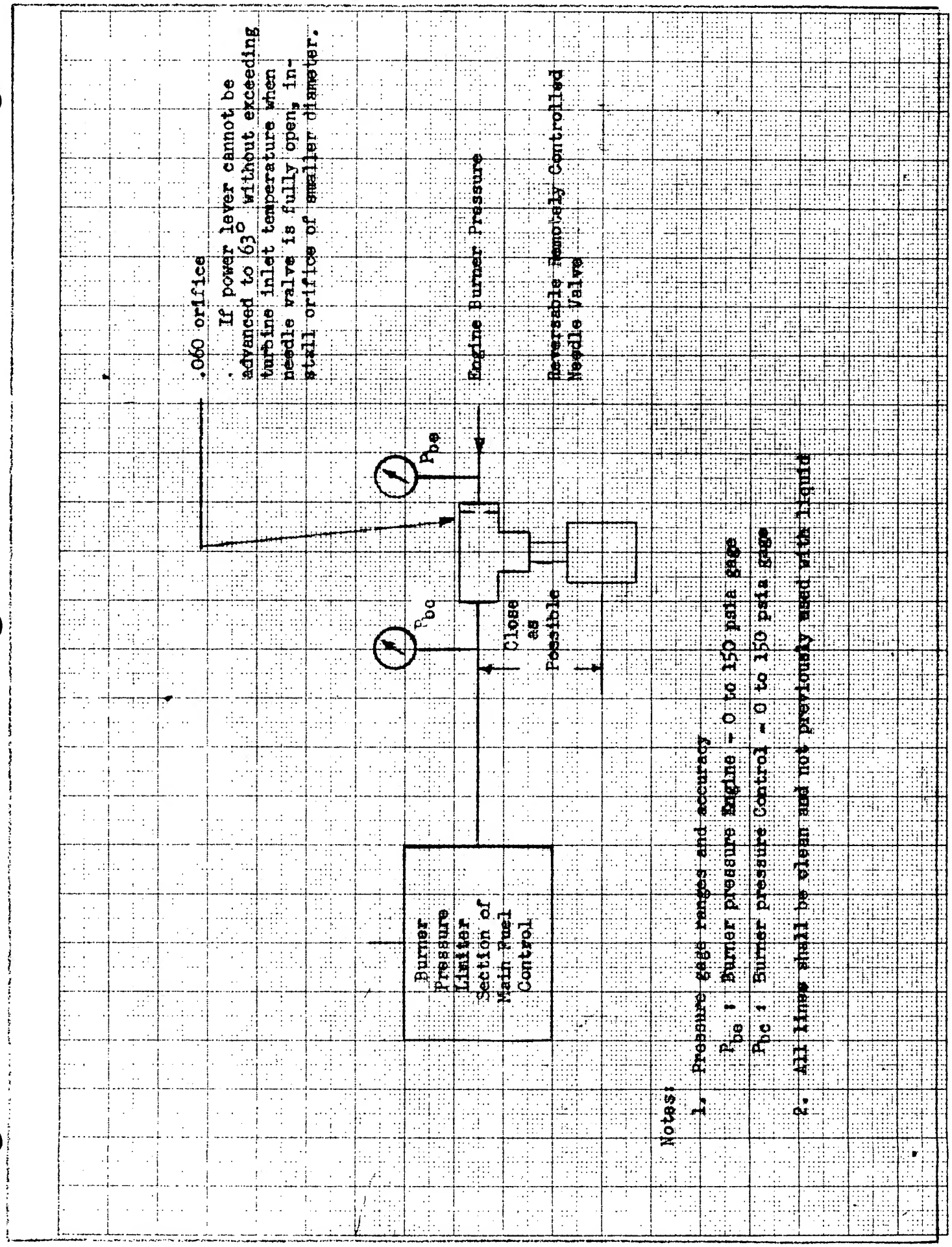
MILITARY POWER LEVER ANGLE

EXHAUST NOZZLE AREA = 7.5 FT^2 OR LESS



12-4-61

FIGURE 12



Notes:
1. Pressure gage ranges and accuracy
P_{be} : Burner pressure Engine - 0 to 150 psia gage
P_{bc} : Burner pressure Control - 0 to 150 psia gage
2. All lines shall be clean and not previously used with liquids

3-12-62

Figure 15

APPENDIX C
TO
J58 TEST INSTRUCTION SHEET

Oil Flow, Bearing and Seal Jets

1. Nature of Tests

To establish proper oil flows to the various bearings and the main shaft seals in the J58 engines.

2. General Requirements

To insure satisfactory operation of the main engine bearings and seals, oil flows must be established within given limits. Records of flow measurements on each engine must be kept.

3. Equipment Required

a. Oil flowbench capable of supplying PWA 524 oil as follows:

1. 0 to 75 lbs/min at 45 psig and 245° to 255°F.

2. 0 to 12 lbs/min at 100 psig and 245° to 255°F.

b. Rotameter or pans and scales to measure oil flow from 0 to 35 lbs/min with an accuracy of ± 3%.

c. Temperature measuring means to observe oil temperature with an accuracy of ± 2°F.

d. Pressure gages to observe oil pressure of 45 psig with an accuracy of ± 1 psi.

e. Oil flow fittings to connect oil supply system to oil in lines.

All fittings and tools shall be approved by Engineering and should be designed in accordance with the following:

1. The fittings shall simulate the engine bill of material oil piping where the pipes are attached to the various oil in fittings.

2. The pressure measuring tap should be located as near as possible to the point of entry of oil into the engine case.

f. Filters of fine mesh (max . 005 opening) must be installed immediately upstream of the pressure measurement points in the oil lines to the engine.

4. Procedure

4.1 General

4.1.1 Measure oil flow from each listed jet assembled with the parts that affect its flow by supplying oil through approved fittings at 45 psig ± 1 psi and 245 to 255°F oil inlet temperature with the exception of the remote gearbox jet which should be flowed at an inlet pressure of 100 psig ± 2 psig. All jets supplied from a common case passage must be flowed together with the listed pressure applied at the case passage inlet or at the inlet of test parts of identical passage design. However, it is permissible that the accessory gearbox bevel gear jet be flowed separately.

4.1.2 Flows should not be taken until the oil leaving the jet has reached a minimum of 245°F. The jet discharge shall be to the open air or to a hose of not less than 5/8-inch inside diameter adapted to the jets by fittings that do not restrict the flow.

4.1.3 Determine that the oil flows through the listed jets are within the values specified in the following table at an inlet pressure of 45 psig ± 1 psi and 245° to 255°F oil temperature, with the exception of the remote gearbox jet which should be flowed at 100 psig ± 2 psi.

Supply Fitting Connection	Oil Jet	Oil Flow lbs/min
Inlet Case	#1 Bearing Spray Jet	2 1/2 to 3 1/2
	#1 Bearing Inner Race and Seal Spacer	8 to 9

Supply Fitting Connection	Oil Jet	Oil Flow lbs/min
Fixture	#2 Forward Bearing Distributing Ring (Total 2 Jets)	18 to 19
	#2 Rear Bearing Distributing Ring (Total 2 Jets)	18 to 19
	#2 Forward Seal Distributing Ring (Total 2 Jets)	13 to 14
	#2 Rear Seal Distributing Ring (Total 2 Jets)	13 to 14
#2 Bearing Support	#2 Forward Bearing and Seal Distributing Ring (Total 4 Jets)	31 to 33
	#2 Rear Bearing and Seal Distributing Ring (Total 4 Jets)	31 to 33
	Bevel Drive Gear Jet	1 to 2
	Bevel Drive Gear Bearing Jet	2 to 3
Exhaust Case	#3 Bearing and Seal Scoop	7 to 8
	#3 Seal Liner	4 to 5
Accessory Gearbox	Accessory G/B Bevel Gear	8 to 9
Reduction Gearbox	Reduction G/B Jet	7 to 9
*Remote Accessory Gearbox	Remote B/G Jet	8 to 10

*The remote gearbox jet flow is specified at an inlet pressure of 100 psig and 245° to 255°F oil temperature.

4.2 Number 1 Compartment

Flow the number 1 compartment with the number 1 bearing support mounted in the inlet case. The bearing and seal jets must discharge the oil parallel to the engine center line and must not be skewed. A reduced pressure may be used for directional check provided no droop of the jet flow is encountered. Use an approved oil inlet fitting.

4.3 Number 2 Compartment

4.3.1 Locate the number 2 bearing front oil distributing ring and scoop in a fixture. Plug the two bearing jets and flow the two seal jets. With the scoop in the proper position the flow from the two jets must enter the scoop. A reduced pressure may be used for this check provided no droop of the jet flow is encountered. Remove plugs from the two bearing jets and plug the two seal jets. Flow the two bearing jets. The flow from the two bearing jets must enter the scoop. A reduced pressure may be used for this check provided no droop of the jet flow is encountered.

4.3.2 Locate the number 2 bearing rear oil distributing ring and scoop in a suitable fixture and repeat 4.3.1.

4.3.3 After the front and rear number 2 bearing oil distributing rings have been flowed in the fixture, install these in the number 2 bearing housing. Spacers may be used in place of the bearing and scoops. Use a suitable fixture and reflow. The total flow of the four jets (two bearings, two seals) on the forward bearing and seal distributing ring must be within limits specified in table. The same applies to the rear bearing and seal distributing ring. At this time, measure the oil flow from the bevel drive gear jet and the bevel drive gear bearing jet.

4.4 Number 3 Compartment

Flow the number 3 bearing jet and the number 3 seal liner. These parts need not be installed in the number 3 support for this check. Use the Bill of Material oil supply tube with a Viton A O-ring seal P/N MS 9021-12. Use a suitable fixture for oil-in adapter. The spray from the jet should not be skewed. If the seal liner flow is high, check for leaks around strainer housing, liner oil supply tubes and out the breather.

4.5 Accessory Gearbox

Flow the accessory gearbox bevel gear jet using an approved fitting for oil-in and plug the number 2 compartment supply.

4.6 Reduction Gearbox

Flow the reduction gearbox jet using a suitable oil inlet fitting.

4.7 Remote Accessory Gearbox

Flow the remote accessory gearbox jet using a suitable oil inlet fitting.

Approved: [redacted] STAT

APPENDIX D
TO
J58 TEST INSTRUCTION SHEETS
BENCH TEST COMPRESSOR REAR THRUST BEARING

1. Nature of Test

To demonstrate the ability of the Compressor Rear Thrust Bearing to meet the J58 engine requirements.

2. General Requirements

To pretest the bearings prior to engine installation to ensure that the bearings are free from manufacturing and metallurgical defects.

3. Equipment Required

A test rig, gearbox and drive motor to test the bearings under the conditions listed below. The bearing will be tested as a set in the test rig. The ring and scoop assemblies and the ring and baffle assembly used with the set of bearings should be the actual engine parts or a functional equivalent. The O.D. of the hub, the I.D. of the bearing adapter, and the oil supply and oil drain paths will all simulate engine design. Provision must be made for free exit of oil from both ends of each pair of bearings. Estimated total power requirement is 55 hp.

4. Procedure

a. Bearings are to be installed in pairs with the oil distributing rings, scoops and baffle assembly such that the axial load shall be exerted against the puller groove side of the inner race. The highest serial number bearing of each pair should be placed in the rear position. The FRONT marking on the distributing rings and scoops refers to the direction in which the thrust is applied to each bearing pair through the shaft and must be respected during assembly of the bearing, rings, scoops, and baffles in the test rig. The "X" marks on the inner races must be aligned and also the "H" marks on the aft side of the inner and outer races must be aligned.

b. The front and rear oil distributing rings should be oil flowed using PWA 521 oil at 45 psi ± 1 psi at an oil temperature of 245° to 255°F to ensure proper oil flow to the bearings. See the following table for flow requirements.

Oil Jet	Oil Flow lb/min
No. 2 Forward Seal Slinger (Total 2 jets)	13 to 14
No. 2 Rear Seal Slinger (Total 2 jets)	13 to 14

Issued: 10-16-61
Revised: 3-10-62, 4-6-62

No. 2 Forward Bearing Slinger (Total 2 jets) 18 to 19
No. 2 Rear Bearing Slinger (Total 2 jets) 18 to 19

See Appendix C for flow check procedure of the oil distributing rings.

c. Oil flow to the rig shall be 62 to 66 lb/min* at 245° to 255°F with a rig operating pressure of approximately 45 psig. The oil shall conform to PWA 521 and shall be passed through a 200 mesh filter before reaching the bearings. The oil should be changed every 50 running hours.

*If tooling which does not incorporate seal jets is used in place of engine ring and scoop assemblies and the ring and baffle assembly, the total oil flow to rig may be reduced to 36 to 38 lb/min.

d. The temperature of the surface of the outer race of each bearing shall be measured and recorded at three positions circumferentially, and the average temperature of each bearing shall not exceed 350°F. The temperature spread between the front and the rear bearing shall not exceed 25°F.

e. The following program shall be run on each pair of bearings:
**Make four accelerations from 4000 rpm to 7000 rpm ± 300 rpm with a 4000 pound axial load. Time for speed change to be 5 to 7 seconds.

Time hours	Axial Load pounds	Tolerance	Speed rpm
1	** 3500	± 3%	7000 ± 100 rpm
1	6000	± 3%	7000 ± 100 rpm
1.5	11,000	± 2%	7000 ± 100 rpm
1.5	17,300	± 2%	7000 ± 100 rpm

Note: A minimum of 3500 lb axial load must be applied to the bearings at all times including starting and stopping.

**The first 15 minutes of this period may be run with a minimum oil temperature of 175°F.

f. At the completion of test the bearings are to be given a visual inspection for pits, inclusions, and excessive cage wear resulting from the bench testing.

STAT

Issued: 10-16-61
Revised: 3-10-62, 4-6-62

Approved: [redacted]

APPENDIX A
TO
J58 TEST INSTRUCTION SHEETS

COMPARTMENT AIR CHECKS

1. Nature of Tests

1.1 To provide a method for checking air leaks into the various engine compartments during engine build.

1.2 To ensure suitable lubrication of bearings and cooling of seals by determining that oil passages are clear and properly sealed in the assembled engine.

2. General Requirements

2.1 Measure the airflow through the specified bearing compartments by introducing air through the breather fittings into each section as specified. The rotor may be turned if necessary to seat the seals during these compartment checks. The lowest flow (as the rotor is turned) shall be used for acceptance.

2.2 Measure the airflow through the individual bearing sections by introducing air through the pressure oil line into each bearing section.

3. Equipment Required

3.1 Airflow meters, pressure gage, and air pressure regulator (set at 10 psig). Instruments should have an accuracy of ± 1%.

3.2 Special fittings and plugs as outlined in the procedure for each compartment. These fittings and plugs are to be approved by Project Engineering.

4. Procedure for Checking Air Leaks into Engine Compartments

4.1 No. 1 Compartment.

4.1.1 With the bearing support mounted in the inlet case and the front accessory drives cover in place, plug the oil pressure and scavenge lines (2) and the rear of compartment.

4.1.2 Pressurize the compartment through the breather line.

4.1.3 No leakage is allowed at 10 psig.

4.1.4 After the completion of the assembly of the compressor and with the front accessory drives cover in place, plug the oil pressure and scavenge lines.

4.1.5 Pressurize the compartment through the breather line.

Issued: 10-23-61
Revised: 3-10-62, 4-3-62

4.1.6 Any leakage in excess of 6 pph at 10 psig shall be cause for rejection.

4.2 No. 2 Compartment

4.2.1 After the compressor is completely assembled and prior to mating with the diffuser case, plug the tower shaft opening on the No. 2 bearing housing.

4.2.2 Pressurize the compartment through the fitting provided.

4.2.3 Any leakage in excess of 14 pph at 10 psig shall be cause for rejection.

4.2.4 After the compressor has been completely assembled and mated with the diffuser case, plug the tower shaft opening on the diffuser case.

4.2.5 Pressurize the compartment through the fitting provided.

4.2.6 Any leakage in excess of 17 pph at 10 psig shall be cause for rejection.

4.2.7 After the compressor has been married to the turbine, and with the accessory gearbox and oil pump in place, cover the following ports on the gearbox:

a. Scavenge port
b. Oil in port
c. PTO pad

4.2.8 Pressurize the compartment through the breather port.

4.2.9 Any leakage in excess of 21 pph at 10 psig shall be cause for rejection.

4.3 No. 3 Compartment

4.3.1 With the accessory drives cover in place and the front of the compartment plugged, cover the scavenge port, breather, and pressure port.

4.3.2 Pressurize the compartment through the fitting provided on the breather port.

4.3.3 No leakage allowed at 10 psig.

4.3.4 After the assembly of the turbine is complete, the oil in, and the breather and scavenge lines have been brazed to the accessory drives cover, plug the scavenge and pressure line.

4.3.5 Pressurize the compartment through the breather line.

4.3.6 Any leakage in excess of 6 pph at 10 psig shall be cause for rejection.

5. Procedure for Checking Lubrication

5.1 The engine should be completely assembled with the exception of the following parts:

a. All afterburner inner and outer ducts (one cone).

b. Pressure oil lines.

5.1.1 As an alternative to 5.1 above, this test may be made on subassemblies completed and ready for engine assembly. If subassemblies are disassembled after airflow, the airflow check must be repeated after re-assembly.

5.2 Determine the airflows through the sections listed and record.

Location	Air Pressure
No. 1 Compartment	10 psig
No. 2 Compartment (including Gearbox and Reduction Gearbox)	10 psig
No. 3 Compartment	10 psig
Reduction Gearbox	10 psig
Remote Accessory Gearbox	10 psig
Turbopump	10 psig

6. Paragraph 4 and 5 shall be accomplished for all builds.

7. A record of the measured airflows and air leakage for each check should be kept for each engine.

Approved: [redacted] STAT

Issued: 10-23-61
Revised: 3-10-62, 4-3-62

APPENDIX E
TO
J58 TEST INSTRUCTION SHEETS

BENCH TEST FOR REMOTE GEARBOX ASSEMBLY

1. Quantity to be Tested

100 percent of the remote gearboxes shall be tested.

2. General Requirements

To run an acceptance test on the remote gearbox.

2.1 Remote fuel-oil cooler optional during testing.

3. Equipment Required

3.1 A power source capable of supplying 50 horsepower at 10,000 rpm.

3.2 A cooling system including supply tank and cooler.

3.3 PWA 524 oil for remote gearbox sump.

3.4 A jumper line to connect the "oil in" and "oil out" ports on the alternator drive. See Para. 4.2 of "Procedure" for special jumper line requirements.

4. Procedure

4.1 Fill the remote gearbox sump with PWA 524 oil to the proper level where it flows out of the oil level port and then cap off this port.

4.2 Connect the jumper line to the "oil in" and "oil out" ports on the alternator drive. A loading valve must be placed in this line with a pressure gage and thermocouple between the valve and the "oil in" port. Keep the oil pressure regulated with the valve between 100 and 150 psig. Maintain the oil temperature at 300 ± 25°F for all running by regulating the temperature through the stand cooling system option or the remote gearbox fuel oil cooler.

ISSUED: 10-23-61
REVISED: 3-9-62

4.3 Run the following schedule:

	Time (Minutes)	Drive Shaft Speed REV/MIN
	0-5	3,000
	5-20	6,000
1 1/2	20-150	10,000
3 hrs.	150-180	3,000
	180-190	6,000
	190-240	10,000
	240-250	Gradual Deceleration to Shutdown

5. Diassembly and Inspection

Upon completion of the acceptance test, the gearbox shall be removed from the test stand for inspection. After satisfactory completion of inspection, the gearbox shall be reassembled and prepared for shipment in accordance with Engineering Instruction No. 122.

APPROVE [redacted] STAT

APPENDIX F
TO
J58 TEST INSTRUCTIONS SHEET

OIL PUMP ASSEMBLY STATIC AIR AND OIL LEAKAGE CHECK

1. Nature of Test

   1.1 To ensure no leakage around pads and covers under static air pressure.

   1.2 To ensure no leakage past the pump carbon seal face and pump body cover under static oil pressure.

2. General Requirements

   2.1 To ensure no leakage around pads and covers when subjected to a static air pressure of 30 psig.

   2.2 To ensure no leakage past the carbon seal and body cover when subjected to a static oil pressure head of two feet of oil.

3. Equipment Required

   3.1 An air or nitrogen supply capable of supplying 30 psig pressure.

   3.2 A tube and connector to connect to the pump inlet.

   3.3 A supply of PWA 524 oil at 200° to 250°F temperature.

   3.4 A splined shaft to rotate pump gears.

   3.5 A container to establish the proper head of oil above pump inlet, including facilities to mount container.

   3.6 Special fittings and caps as outlined in procedure. These fittings and caps are to be approved by Project Engineering.

4. Procedure

   4.1 Cap off the pump discharge and cooler bypass line.

   4.2 Connect the air or nitrogen pressure source to the pump inlet.

   4.3 Subject the assembly to 30 psig pressure and observe all pads and covers for leakage. Leakage is acceptable only by the carbon seal and the oil pump body cover.

Issued: 10-17-61
Revised: 3-10-62

4.4 Connect the oil supply to the pump inlet.

4.5 Rotate the pump gears sufficiently to ensure that the pump body cavity is filled with oil.

4.6 Cap off the pump discharge and cooler bypass line.

4.7 Establish a two-foot head of oil above the pump inlet with the pump in position relative to engine mounting.

4.8 Collect leakage by the carbon seal and the pump body cover. No leakage is acceptable.

5. Failure to meet the above requirements shall be cause for rejection.

Approved [ ] STAT

Issued: 10-17-61
Revised: 3-10-62

APPENDIX G
TO
J58 TEST INSTRUCTION SHEETS
ENGINE AND COMPRESSOR AIR LEAK CHECK

1. Nature of Test

   1.1 To provide a method of checking air leaks from the engine assembly.

   1.2 To provide a method of checking air leaks from the compressor assembly.

2. General Requirements

   2.1 Measure the air leakage from the engine assembly less afterburner.

   2.2 Measure the air leakage from the compressor assembly to determine the amount of air leakage that can be attributed to the internal and external bleed system.

3. Equipment Required

   3.1 Air supply capable of maintaining an airflow of 1.5 pps at 7 1/2 psig.

   3.2 Flow measuring system capable of measuring flows up to 2 pps.

   3.3 0 to 10 psig pressure gages.

   3.4 Special covers, fittings, and plugs as called for in the Procedure. These covers, fittings, and plugs must be approved by Engineering.

   3.5 Hydraulic unit capable of supplying 2 GPM at 400 psi pressure to bleed actuators.

4. Procedure

   4.1 Engine Assembly

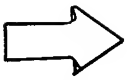
   4.1.1 After the engine assembly has been completed and before installing the afterburner, install pressure plate on the inlet case and the rear flange of the A/B diffuser case. These pressure covers are to include ports for introducing measured airflow into engine.

Issued: 3-12-62
Revised: 3-21-62

4.1.2 Connect compressor discharge and turbine discharge instrumentation probes to pressure gages.

4.1.3 Cover or plug all additional instrumentation probes and all bosses on engine and components.

4.1.4 Connect air supply and flow measuring system.



4.1.5 Connect the hydraulic unit to external bleed system and pressurize to 400 psig.

4.1.6 Pressurize the engine through the supply lines to the two pressure plates on front and rear of engine.

Caution: Do not exceed 9 psig.

4.1.7 Record the leakage at pressures of 5 psig and 7 1/2 psig.

4.2 Compressor Assembly

4.2.1 After the compressor assembly has been completed and before installing fuel manifolds, install covers over the fuel manifold bosses on the diffuser case.

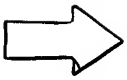
4.2.2 Install pressure covers on the inlet case and the rear of the diffuser case.

4.2.3 Install blank-off plates on the bleed case exit ports.

4.2.4 Install pressure taps on station 3 instrumentation.

4.2.5 Cover all additional instrumentation and bosses.

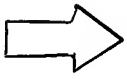
4.2.6 Connect air supply and flow measuring system.



4.2.7 Connect the hydraulic unit to the external bleed system and pressurize to 400 psig.

4.2.8 Pressurize the compressor through air supply lines.

4.2.9 Record the leakage at pressures of 5 psig and 7 1/2 psig.



4.2.10 Disconnect the hydraulic unit from the external bleed system and connect to the internal bleed system and pressurize to 400 psig.

4.2.11 Remove the blank-off plates from the bleed case exit ports.

4.2.12 Pressurize the compressor through the air supply lines.

4.2.13 Record the leakage at pressures of 5 psig and 7 1/2 psig.

Approved: _____ STAT

Issued: 3-12-62
Revised: 3-21-62

WILL BE KEPT UP TO DATE

This Schedule is Applicable For
Vendors When Referenced in PWA
Purchase Specification Or Directed
By PWA Engineering

PRATT & WHITNEY AIRCRAFT
FLORIDA RESEARCH AND DEVELOPMENT CENTER

COMPONENT CALIBRATION SCHEDULE FOR AFTERBURNER FUEL CONTROL, PWA P/N 2057440 (HSD JFC-51, P/N HS 576400) J58 (JT11) ENGINES

1. QUANTITY TO BE TESTED

All of the afterburner fuel controls, PWA P/N 2057440, shall be bench tested at P&WA in accordance with this Component Calibration Schedule prior to installation on an engine.

2. GENERAL REQUIREMENTS

2.1 Equipment Requirements

2.1.1 Flowbench capable of supplying 2000 to 65,000 pph fuel flow at 100 to 1000 psig and 4000 pph at 1500 psig.

2.1.2 Hoist to be used for mounting and demounting the control on the flowbench. The hoist shall be capable of lifting 200 pounds.

2.1.3 Pneumatic Pressure Source and Regulator for simulating burner pressure, capable of supplying and maintaining any pressure from ambient to 220 psia.

2.1.4 Fuel Pressure Source and Regulator for simulating arming signal pressure (P_a), capable of supplying and maintaining any pressure from 50 to 300 psig at up to 500 pph fuel flow. A loop from control inlet pressure to tank containing a .020 to .035-inch diameter orifice and a manually adjustable regulating valve, as shown in figure 2, may be used to provide the P_a signal pressure.

2.1.5 Spray Bar Simulation

Zone I - asimulator for simulating the Zone I spraybar meeting the requirements of figure 3 and calibrated during the control bench test as specified.

Zone II- A pressure regulating valve to maintain the Zone II discharge pressure at 65 to 85 psi below Zone I control discharge at each test point and calibrated during the control bench test as specified.

Issued: 10-6-61
Revised: 3-6-62

2.1.6 PLA Protractor to measure power lever angle with a range of -10° to $+130^{\circ}$. The protractor scale shall be divided into at least $1/2^{\circ}$ increments. With the protractor installed on the control and moved to any scale division, the control lever shall be positioned with an accuracy of $\pm 1/4^{\circ}$ of indicated reading. A 0.0920 to 0.0925-inch daimeter pin is also required to measure the location of the control power lever index hole.

2.1.7 Temperature Apparatus for simulating T_{t2} temperature, capable of providing constant temperatures of $-65^{\circ} \pm 5^{\circ}F$, $+59^{\circ} \pm 5^{\circ}F$, $+150^{\circ} \pm 5^{\circ}F$, $+550^{\circ} \pm 10^{\circ}F$, and $+750^{\circ} \pm 10^{\circ}F$.

2.1.8 Heat Exchanger to maintain the fuel inlet temperature at the control inlet and the flow measurement inlets at $100^{\circ} \pm 5^{\circ}F$.

2.1.9 Filter containing a 25 to 40 micron element and installed in the test stand line supplying fuel to the control inlet.

2.1.10 Torque Measuring Equipment to measure PLA torque of 5 to 30 inch-pounds with an accuracy of $\pm$ 1.0 inch-pounds within this range and to install control pressure plugs at 420 to 660 inch-pounds with an accuracy of $\pm$ 20 inch-pounds within this range.

2.1.11 Pressure Relief Valves or Burst Discs installed in the control inlet line and low return line capable of the following:

Inlet Line - limit inlet pressure to 1500 psig maximum and capable of flowing 65,000 pph when on pressure relief.

Low Return Line - limit body pressure to 100 psig maximum and capable of flowing 3000 pph when on pressure relief.

Discharge Line - to limit discharge pressure to 1000 psig maximum during the 3.3.12.2 leakage test and capable of flowing 65,000 pph when on pressure relief.

2.1.12 Graduate for measuring leakage through the cooling flow shutoff valve and the discharge shutoff valves, at least 500 cc capacity with scale markings in at least 10 cc increments.

2.1.13 Pressure Regulator capable of maintaining control body pressure at 50 $\pm$ 5 psig at flow rates through the low return line of 500 to 2000 pph.

2.1.14 Bleed Reset Fixture to position and hold the bleed reset link on the control in either the "bleeds open" or "bleeds closed" position.

2.1.15 Test Fittings to install in control pressure ports.

2.1.16 Hand Valves installed as shown on figure 2.

2.1.17 Instrumentation for taking the measurements listed below:

W_{f_1} - Zone I Metered Fuel Flow of 2000 to 65,000 pph with an accuracy of at least ± 1/2% of indicated reading within this range. Observed fuel flows shall be corrected in accordance with the most recent production test flow measurement correction curves.

W_{f_t} - Total Metered Fuel Flow of 2,000 to 65,000 pph with an accuracy of at least ± 1/2% of indicated reading within this range. Observed fuel flows shall be corrected in accordance with the most recent production test flow measurement correction curves.

W_{f_c} - Cooling Fuel Flow of 2000 to 4000 pph with an accuracy of at least ± 1% of indicated reading within this range.

P_o - Control Body Pressure of 20 to 100 psig with an accuracy of ± 2 psig within this range.

P_i - Control Inlet Pressure of 100 to 1000 psig with an accuracy of ± 3 psig within this range.

P_a - Arming Signal Pressure of 25 to 300 psig with an accuracy of ± 3 psig within this range.

P_b - Simulated Burner Pressure of 10 to 220 psia with an accuracy of at least ± 0.3 psia of indicated reading from 10 to 60 psia and at least ± 0.5% of indicated reading from 60 to 220 psia.

$TV\Delta P$ - Throttle Valve Differential Pressure ($P_1 - P_2$) of 10 to 60 psi with an accuracy of ± 1 psi within this range.

$R\Delta P$ - Regulated Differential Pressure ($P_1 - P_3$) of 25 to 100 psi with an accuracy of ± 1psi within this range.

P_{1_D} - Zone I A/B Discharge Pressure of 100 to 1000 psig with an accuracy of ± 5 psig within this range.

P_{1_R} - Zone I Spraybar Simulator Discharge Pressure of 5 to 50 psig with an accuracy of ± 1 psig within this range.

P_{2_D} - Zone II A/B Discharge Pressure of 100 to 1000 psig with an accuracy of ± 5 psig within this range.

T_{T_2} - Simulated Compressor Inlet Temperature of -70° to + 750°F with an accuracy of ± 8°F within this range.

T_i - Control Inlet Fuel Temperature of 80° to 120°F with an accuracy of ± 2°F within this range.

T_{f_l}, T_{f_t}, T_{f_c} - Fuel Temperature at W_{f_l}, W_{f_t}, and W_{f_c} flow measurement inlets respectively of 80° to 120°F with an accuracy of ± 2°F within this range.

2.2 Test Fluid

Test Fluid shall be PMC 9073.

2.3 Depreservation

If the control has been preserved with flushing oil, it must be depreserved in accordance with Engineering Instruction No. 125.

2.4 Installation

2.4.1 The control shall be mounted on the flowbench in the test position shown on figure 1.

2.4.2 The P_2 pressure line to the TVΔP gage, and P_3 pressure line to the RΔP gage shall be connected to test fittings installed in the appropriate control pressure ports. All other pressure connections shall be made on flowbench lines as close to the control as possible.

2.5 Data to be Recorded

2.5.1 The following data shall be recorded on each data sheet:

PWA Part Number
Control Serial Number
HSD Parts List and Revision Number
Test Fluid Type

2.5.2 The following data shall be recorded at each calibration point:

PLA, P_b, P_o, P_a, P_i, T_i, T_{t_2}, RΔP, TVΔP, and Bleed Reset Position

2.5.3 The following data shall be recorded when noted in the calibration procedure:

W_{f_l}, W_{f_t}, W_{f_c}, P_{l_D}, P_{l_R}, P_{2_D} and leakage. Whenever W_{f_l}, W_{f_t}, and W_{f_c} data is specified, the appropriate flow measurement fuel inlet temperature T_{f_l}, T_{f_t}, or T_{f_c} shall be recorded.

3. TEST REQUIREMENTS

3.1 Applicable Limits

3.1.1 As Received limits, when given, shall be used for all controls received from the vendor and run without adjustment. Also, if control adjustment is required, the As Received limits shall remain applicable for sections of the calibration procedure not affected by the adjustment which do not require the section to be run after adjustment.

3.1.2 Standard limits shall be used for sections affected by an adjustment that require the section to be re-run after the adjustment. These sections are listed in 3.1.3.

3.1.3 Adjustments. The following adjustments are the only adjustments permitted. Whenever an adjustment is made. the sections listed shall be re-run and must then meet the Standard limits specified. All adjustments must be locked or wired before the final run of the sections specified. Any plugs removed shall be treated with "Silver Goop." Thread lubricant on the threads and rubbing faces and reinstalled with a torque of 420 to 660 inch pounds.

Adjustment	Paragraphs to Re-Run
1. Power Lever Pilot Valve	3.3.6, 3.3.7, 3.3.9, 3.3.10
2. Zone 2 Transfer	3.3.8
3. Peak Sensor	3.3.6 (59°F T_{t_2} only)
4. Main Sensor	3.3.6, 3.3.7, 3.3.8
5. Pump Controller	3.3.5.2
6. Power Lever Rate	3.3.6, 3.3.7, 3.3.9, 3.3.10
7. Throttle Operated Pilot Valve	3.3.4

3.2 General Requirements

3.2.1 The following conditions shall be maintained unless specified otherwise:

Stand plumbing shall be as shown on figure 2.

T_{f_t}	-	100° ± 5°F
T_{f_1}	-	100° ± 5°F
T_{t_2}	-	59° ± 2°F
P_o	-	45 to 55 psig
R Δ P	-	75 to 80 psi
P_a	-	235 to 255 psig
Bleed Reset	-	Bleeds Closed position

3.2.2 The complete calibration shall be performed prior to any adjustments and/or adjustment range tests (Para. 3.3.11)

3.2.3 All test conditions shall be set in the order listed for any one section with the condition set by approaching the test point of the variable in the direction indicated. Any overshoot or undershoot shall require resetting in the proper direction.

3.2.4 Although not specifically shown in the limits of each section, the following limit applies to each section of the test procedure.

Limit: There shall be no external leakage other than an allowable leakage of 30 drops/min from the overboard drain connection.

3.2.5 Fuel flow limits specified are absolute values. Observed fuel flows shall be corrected in accordance with the most recent production test flow measurement correction curves.

3.3 Test Procedure

The order of calibration may be varied as desired after completion of paragraphs 3.3.1 and 3.3.2, except the leakage tests specified in paragraph 3.3.12 must be performed last.

3.3.1 Power Lever Protractor Indexing

3.3.1.1 Install the power lever protractor and set it at 67° ± 1/4° with a 0.0915-0.0925-inch diameter pin inserted through the slot in the stop plate and into the rigging hole in the indexing plate.

3.3.1.2 Remove the rigging pin and advance the power lever counterclockwise until maximum stop is engaged. Hold the power lever against the stop with a torque of 10 inch-pounds, and record PLA.

Decrease PLA until the index plate is against clockwise stop plate (minimum PLA). Record minimum PLA.

Limits: Minimum PLA shall be -3° to -6°. Maximum PLA shall be 119° to 121°.

3.3.2 Control Exercise (data need not be recorded)

3.3.2.1 Operate the control for at least three minutes at 120° PLA, and 100 psia Pb.

3.3.2.2 At 120° PLA, vary P_b from 15 to 200 to 15 psia at least three times in approximately 30 seconds per cycle.

3.3.2.3 At 100 pisa P_b, vary PLA from 120° to 0° to 120° at least three times in approximately 30 seconds per cycle.

3.3.2.4 If the calibration is interrupted and the fuel in the control body allowed to drain, due to control disassembly, control removal, plumbing disconnection, etc., the control

exercise specified in 3.3.2.1, 3.3.2.2 and 3.3.2.3 shall be repeated.

3.3.3 Cooling Flow Calibration and Leakage

3.3.3.1 At 0° PLA and 15 psia P_b, record cooling fuel flow (W_{f_c}).

Limits: W_{f_c} shall be 2940 to 3060 pph. There shall be no indication of W_{f_1} fuel flow.

3.3.3.2 Disconnect the cooling flow line. Install a short line to the cooling flow connection on the control with the end away from the control open. This line shall be such that any flow or leakage from the cooling flow connection can either be diverted to stand drain or collected in a graduate without first having to fill a portion of the line.

At 15 psia P_b, cycle PLA from 0° to 120° to 0° at least three times with the short cooling flow line diverted to drain. Set 120° PLA, wait at least one minute, and then record leakage from the cooling flow line over a three-minute period.

Limits: Leakage from the cooling flow line shall not exceed 300 cc for the three-minute period.

3.3.3.3 Disconnect the short cooling flow line. Install the line from the cooling flow connection to the cooling flow measurement instrument.

3.3.4 Sequencing Calibration

3.3.4.1 At 15 psia P_b and starting from 120° PLA, decrease PLA slowly and record PLA where A/B cutoff first occurs (W_{f_c} = 2940 to 3060 pph and W_{f_1} decreases to zero). Decrease PLA to at least 50°, then increase PLA slowly and record PLA where A/B initiation first occurs (W_{f_1} = 2940 to 3060 pph and W_{f_c} decreases to zero).

Limits: A/B cutoff shall be between 65° and 67° decreasing PLA. A/B initiation shall be between 66° and 67° increasing PLA.

3.3.5 Power Lever Torque and Pump Controller Calibrations

3.3.5.1 At 100 psia P_b and 0° PLA, slowly vary PLA from 0° to 120° to 0° using a torque wrench. Record maximum torque required to move the power lever in each direction.

Limits: Power lever torque shall be between 1 to 10 in-lbs from 0° to 65° to 0° PLA and 1 to 25 in-lbs from 65° to 120° to 65° PLA

3.3.5.2 At 120° PLA and 100 psig P_b, adjust P_i pressure so that R Δ P is 40 to 50 psi. Slowly increase P_i and record R Δ P pressure at which the pump controller output shaft rotates through its full travel.

Limits: The pressure differential R Δ P shall be between 75 and 80 psi when the pump control shaft rotation (CCW) occurs.

3.3.6 Maximum Ratio Calibration - Bleed Closed

As shown on figure 4, record the specified data at each of the specified conditions.

Limits: As shown on figure 4.

3.3.7 Minimum Ratio Calibration - Bleeds Closed

As shown on figure 5, record the specified data at each of the specified conditions.

Limits: As shown on figure 5.

3.3.8 Zone Transfer Calibration - Bleeds Closed

With PLA initially at 60° ± 5° and the conditions specified on figure 6, slowly increase PLA at each P_b specified on figure 6 until zone transfer occurs (W_{f1} value step decreases in value). Record the specified data just prior to transfer and just after transfer.

Limits: As shown on figure 6.

With PLA above zone transfer, slowly decrease PLA until zone II flow stops (W_{f1} value step increases). Record W_{f1} which occurs at maximum value of flow step in zone I.

Limits: P_b's from 20 to 50 psia - 200 to 500 pph below actual value of transfer.

P_b's 50 to 200 psia - 200 to 10 x P_b pph below actual value of transfer.

3.3.9 Compressor Inlet Temperature Sensing Calibration - Bleeds Closed

As shown on figures 7 and 8, record the specified data at each of the specified conditions.

Limits: As shown on figures 7 and 8

3.3.10 Maximum Ratio Calibration - Bleeds Open

As shown on figures 8 and 9, record the specified data at each of the specified conditions.

Limits: As shown on figures 8 and 9.

3.3.11 Power Lever Rate Adjustment Range

With 120° PLA, 100 psia P_b, 59° T_{T_2}, and bleeds closed, turn the adjustment clockwise as far as possible. Record W_{f_t}. Turn the adjustment counter-clockwise as far as possible. Record W_{f_t}. Reset to original W_{f_t} and repeat paragraph 3.3.6

Limits: The adjustment range must be no less than ± 1440 pph from curve setting.

3.3.12 Final Leakage Checks

3.3.12.1 Shutoff Valve Leakage

3.3.12.1.1 Disconnect the two discharge lines. At 0° PLA, 15 psia P_b, and 40 to 50 psig P_1, wait at least two minutes and then record any leakage from either discharge flow standpipe over a one-minute period.

Limits: Leakage from each standpipe shall not exceed 10 drops per minute.

3.3.12.1.2 At 0° PLA, 75 to 80 psi R Δ P, and 15 psia P_b, wait at least two minutes and then record any leakage from either of the discharge standpipes over a one-minute period.

Limits: Leakage from each discharge standpipe shall not exceed 10 drops per minute.

3.3.12.2 External Leakage

Remove the TVΔP and RΔP gages and test fittings. Install control pressure port plugs at P_2 and P_3 locations. "Silver Goop" thread lubricant must be used on the threads and rubbing faces. Torque each plug at 420 to 660 inch-pounds.

Remove the cooling flow line. Interconnect the two discharges and the cooling flow connections directly back to tank with a hand valve, P_d pressure gage, and burst disk or relief valve as shown by dash lines on figure 2.

Install a hand valve on the low return line as shown by dash lines on Figure 2.

Close the arming signal pressure regulator so that P_a pressure will be the same as P_1 pressure.

Set the following conditions and maintain over a five (5) minute period. Record any external leakage and overboard drain leakage over the five (5) minute period.

PLA = 120°
P_D = 675 to 725 psig
P_o = 80 to 85 psig
P_t = 100 to 170 psia

Limits: There shall be no external leakage other than an allowable leakage of 30 drops/min from the overboard connection.

4. PRESERVATION AND STORAGE

After completion of testing, the control shall be prepared for storage in accordance with Engineering Instruction No. 125. Protective covers, containers, and/or stands shall be used to prevent damage or contamination of the control.

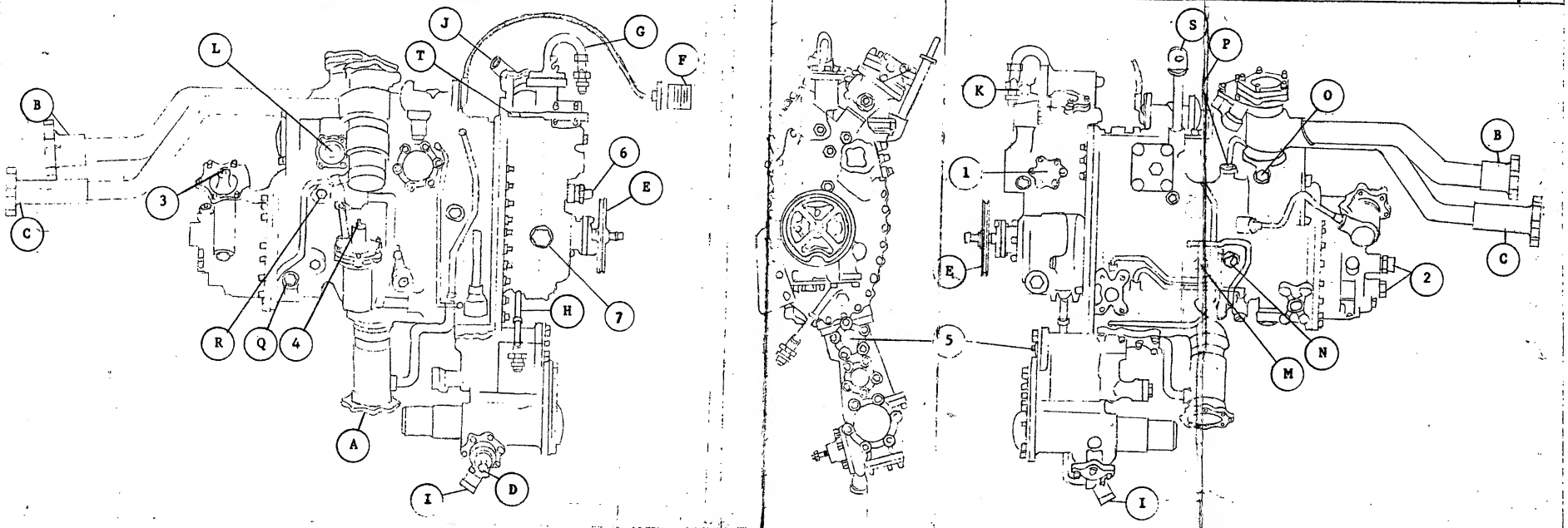
5. APPLICABLE FIGURES

Figure 1	Port Indentification and Test Position	2-6-62
Figure 2	Schematic Diagram	3-6-62
Figure 3	Zone I Spray Bar Simulator Pressurizing Schedule	2-6-62
Figure 4	Maximum Ratio Calibration - Bleeds Closed	3-6-62
Figure 5	Minimum Ratio Calibration - Bleeds Closed	3-6-62
Figure 6	Zone Transfer Calibration - Bleeds Closed	3-6-62
Figure 7	Compressor Inlet Temperature Sense Calibration - Bleeds Closed	3-6-62
Figure 8	Compressor Inlet Temperature Sense Calibration Bleeds Closed and Open	3-6-62
Figure 9	Compressor Inlet Temperature Sense Calibration - Bleeds Open	3-6-62

Issued: 10-6-61
Revised: 3-6

Approved: _____ F. L. Elsaesser

STAT
STAT



CONNECTIONS AND PRESSURE TAPS

A. Fuel Inlet

B. Zone I Outlet

C. Zone II Outlet

D. Pump Control Output Shaft

E. Power Lever Shaft

F. T_{T_2} Bulb

G. Servo Return to Pump Inlet

H. Speed Signal Pressure Connection

I. Overboard Drain

J. Overboard Drain

K. P_b Pressure Connection

L. Circulating Flow Outlet

M. P_2 Pressure Tap

N. P_3 Pressure Tap

O. P_4 Pressure Tap

P. P_5 Pressure Tap

Q. P_0 Pressure Tap

R. P_s Pressure Tap

S. Eyebolt (Lift here)

T. Comp. Bypass Bleed Position Connection

ADJUSTMENTS

1. Power Lever Pilot Valve
2. Zone II Transfer
3. Peak Sensor
4. Main Sensor
5. Pump Controller
6. Power Lever Rate
7. Throttle Operated Pilot Valve

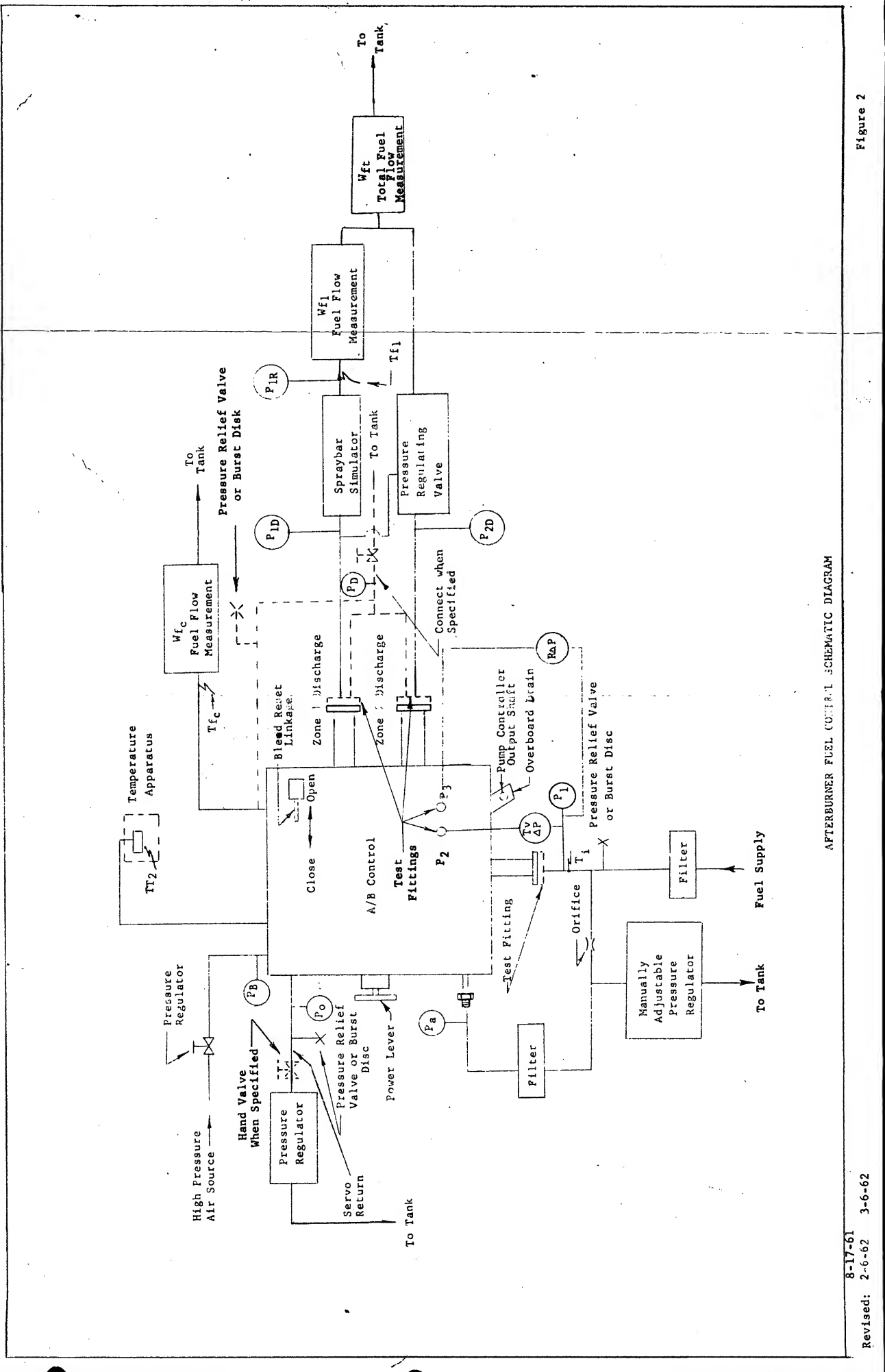
AFTERBURNER FUEL CONTROL
PORT IDENTIFICATION & TEST POSITION

2-6-62

FIGURE 1

Approved For Release 2009/07/08 : CIA-RDP67B00657R000100190001-9

CCS No. J-4



AFTERBURNER FUEL CONTROL SCHEMATIC DIAGRAM

Figure 2

8-17-61
Revised: 2-6-62 3-6-62

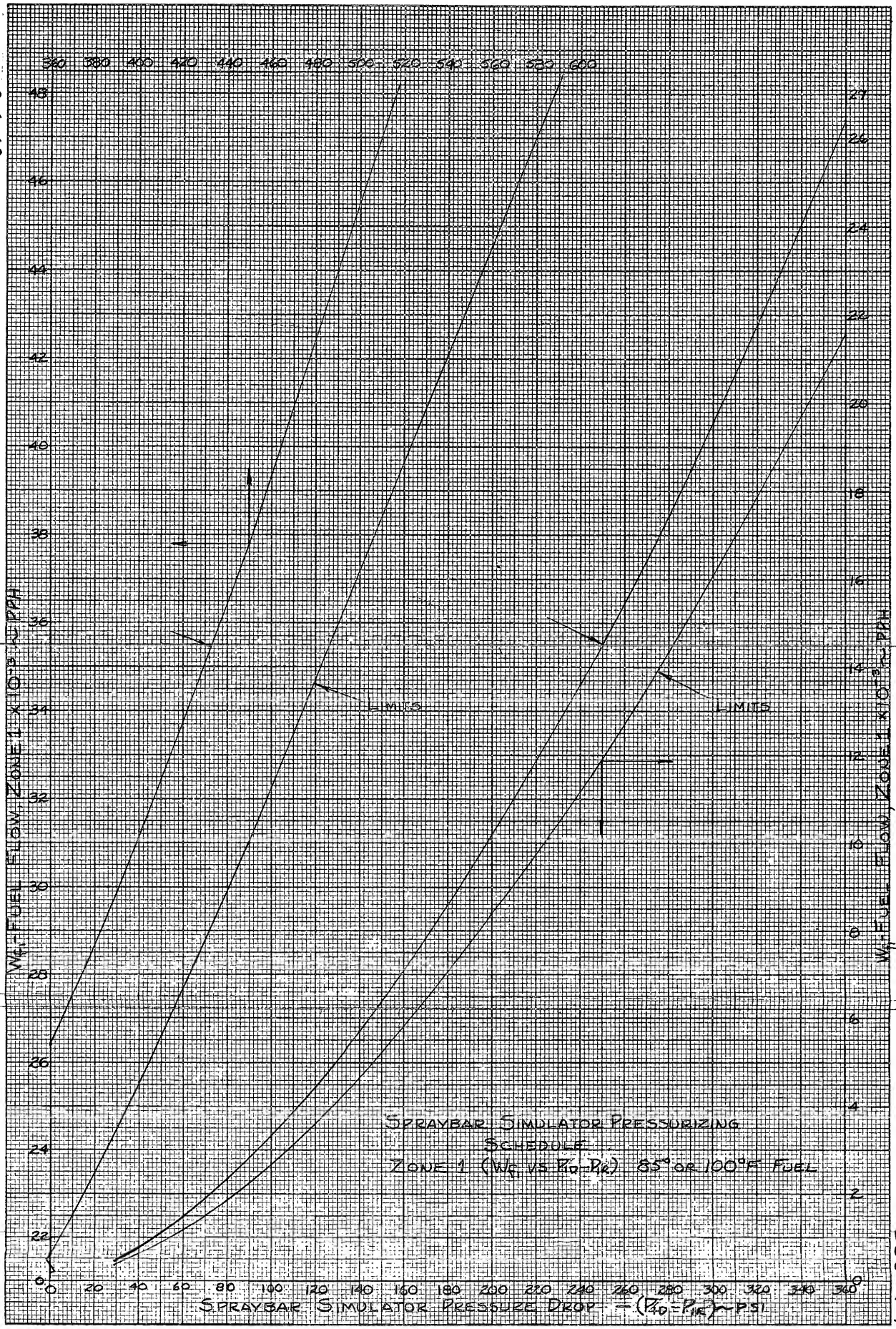


FIGURE 3

CCS #J-4

CCS No. 3-6

MAXIMUM RATIO CALIBRATION - BLEEDS CLOSED

SECTION 3.3.6

T_{T1} = 100° ± 5°F, T_{T2} = 59° ± 2°F, P_0 = 45 to 55 psig, P_a = 235 to 255 psia, RΔP = 75 to 85 psig, Bleeds Reset = Bleeds Closed, PLA = 120° P_B as shown in table.

Record: PLA, P_b, W_{f1}, W_{ft}, T_{T1}, T_{T2}, T_1, T_{T2}, P_b, P_{T1}, P_a, P_{1D}, P_{1R}, P_{2D}, RΔP, TVΔP, and Bleed Reset Position.

Limits: W_{f1} and W_{ft} as shown in applicable table below, See 2.1.5. for (P_{1D} - P_{1R}) and P_{2D} requirements.

	AS RECEIVED LIMITS					
P_b	Total W_{ft} ~ pph			Zone I W_{f1} ~ pph		
psia	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
20	6320	6700	7080	4340	4600	4860
40	12100	12800	13500	8700	9200	9700
60	18100	19150	20200	13050	13800	14550
75	23000	24390	25800	16300	17250	18200
85	27500	29150	30800	18450	19550	20700
100	34200	36000	37800	21700	23000	24300
120	41200	43600	46000	26100	27600	29100
145	43400	46050	48600	31500	33500	35200
180	53600	56700	59800	39000	41400	43800

	STANDARD LIMITS					
P_b	Total W_{ft} ~ pph			Zone I W_{f1} ~ pph		
psia	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
20	6360	6700	7040	4360	4600	4840
40	12150	12800	13450	8750	9200	9650
60	18200	19150	20100	13100	13800	14500
75	23100	24390	25600	16400	17250	18100
85	27700	29150	30600	18550	19550	20600
100	34200	36000	37800	21800	23000	24200
120	41400	43600	45800	26200	27600	29000
145	43800	46050	48400	31700	33350	35000
180	53800	56700	59600	39300	41400	43600

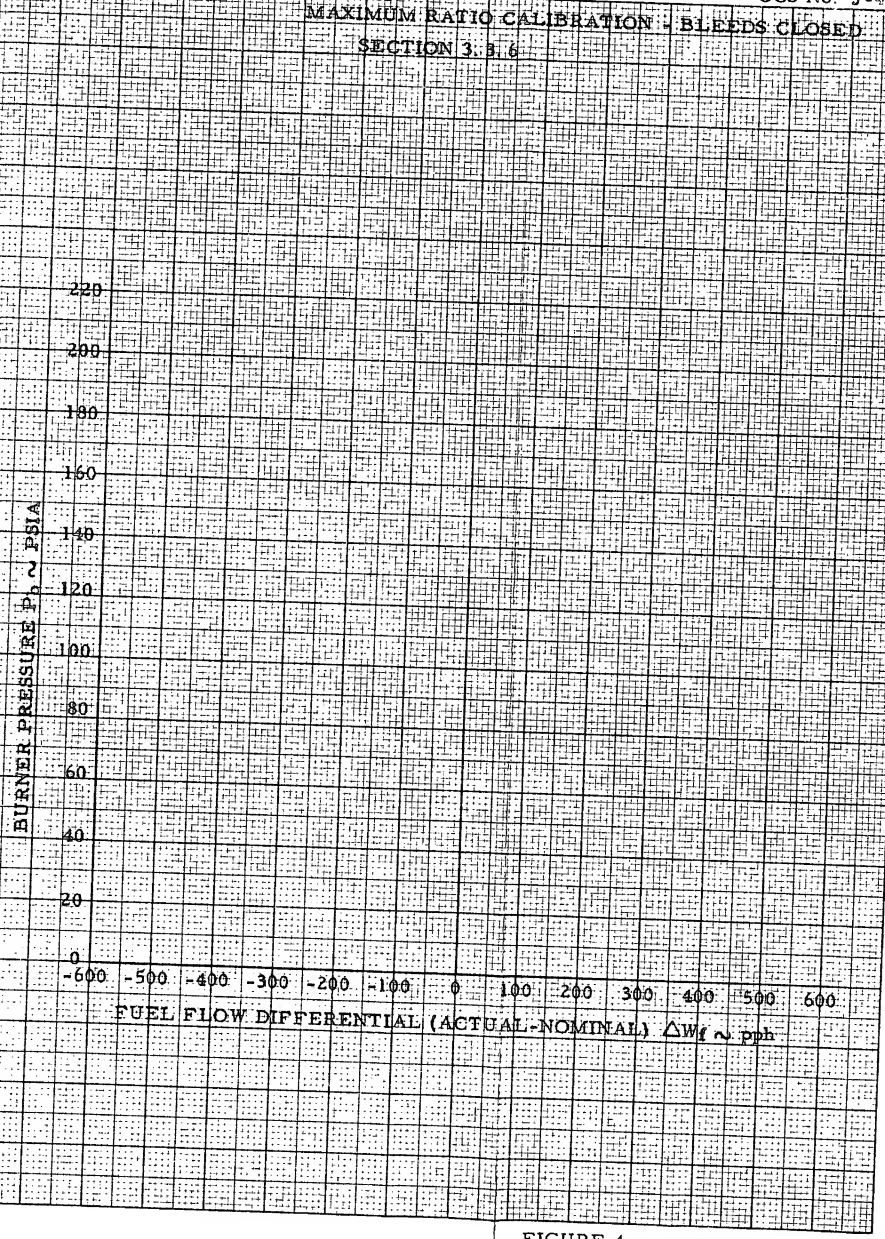


FIGURE 4

3-6-62

MINIMUM RATIO CALIBRATION - BLEEDS CLOSED

SECTION 3.3.7

T_1 = 100° ± 5°F, T_{T2} = 59° ± 2°F, P_o = 45 to 55 psig, P_a = 235 to 255 psig, RΔP = 75 to 85 psig, Bleed Reset = Bleeds Closed, PLA = 68°, P_b as shown in table.

Record: PLA, P_b, W_{f1}, W_{f_t}, T_{f1}, T_{f2}, T_1, TT2, P_o, P_1, P_a, RΔP, TVΔP and Bleed Reset Position

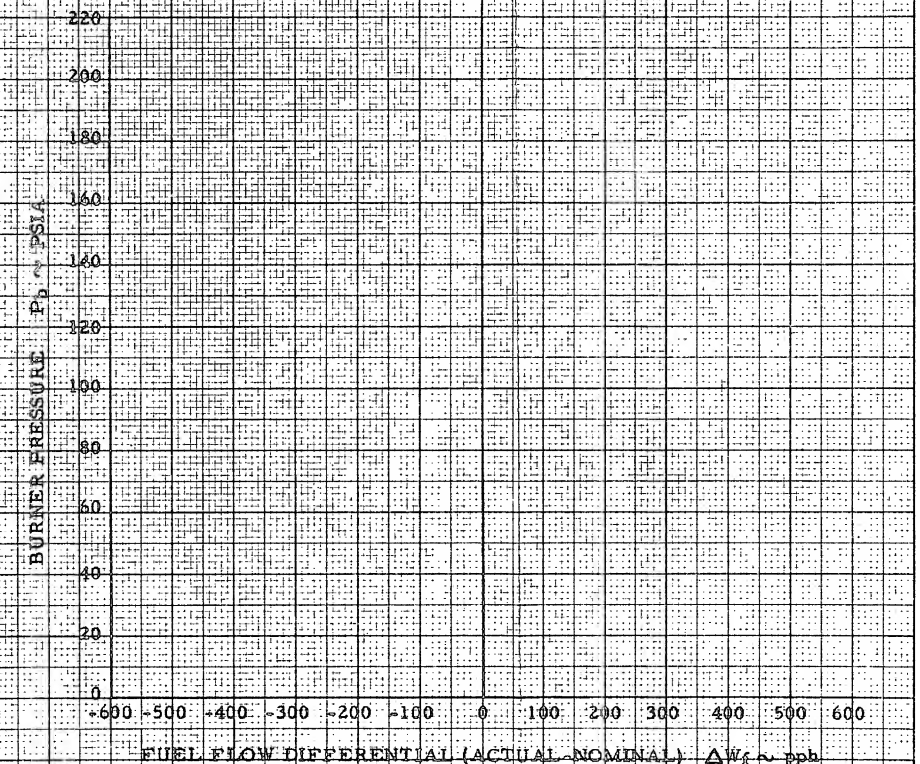
Limits: W_{f1} and W_{f_t} as shown in applicable table below.

AS RECEIVED LIMITS

P_b	Total W_{f1} ~ pph			Zone I W_{f_t} ~ pph		
psia	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
20	2830	3000	3170	2830	3000	3170
40	3200	3400	3600	3200	3400	3600
100	8000	8500	9000	8000	8500	9000
180	14450	15300	16450	14450	15300	16450

STANDARD LIMITS

P_b	Total W_{f1} ~ pph			Zone I W_{f_t} ~ pph		
psia	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
20	2850	3000	3150	2850	3000	3150
40	3230	3400	3570	3230	3400	3570
100	8050	8500	8950	8050	8500	8950
180	14500	15300	16100	14500	15300	16100



3-6-62

FIGURE 5

T_1 = 100° ± 5°F, TT_2 = 59° ± 2°F, P_o = 45 to 55 psig, P_a = 235 to 255 psig, RΔP = 75 to 85 psi, Bleed Reset Position = Bleeds Closed, PLA initially at 0°. Increase PLA at each P_b until transfer occurs.

Record: PLA, P_b, P_o, P_a, P_1, T_1, TT_2, RΔP, TVΔP, Bleed Reset Position, W_{f_1}, W_{f_t}, T_{f_1}, T_{f_2}. (Just prior to transfer and just after transfer.)

Limits: W_{f_1} and W_{f_t} as shown in the applicable table below.

BEFORE TRANSFER

AS RECEIVED LIMITS

P_b	Total W_{f_t} ~ pph			Zone I W_{f_1} ~ pph		
psia	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
20	5240	5560	5880	5240	5560	5880
50	13100	13900	14700	13100	13900	14700
100	26200	27800	29400	26200	27800	29400
150	39400	41700	44000	39400	41700	44000
180	47200	50000	52800	47200	50000	52800

STANDARD LIMITS

P_b	Total W_{f_t} ~ pph			Zone I W_{f_1} ~ pph		
psia	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
20	5280	5560	5840	5280	5560	5840
50	13200	13900	14600	13200	13900	14600
100	26400	27800	29200	26400	27800	29200
150	39600	41700	43800	39600	41700	43800
180	47400	50000	52600	47400	50000	52600

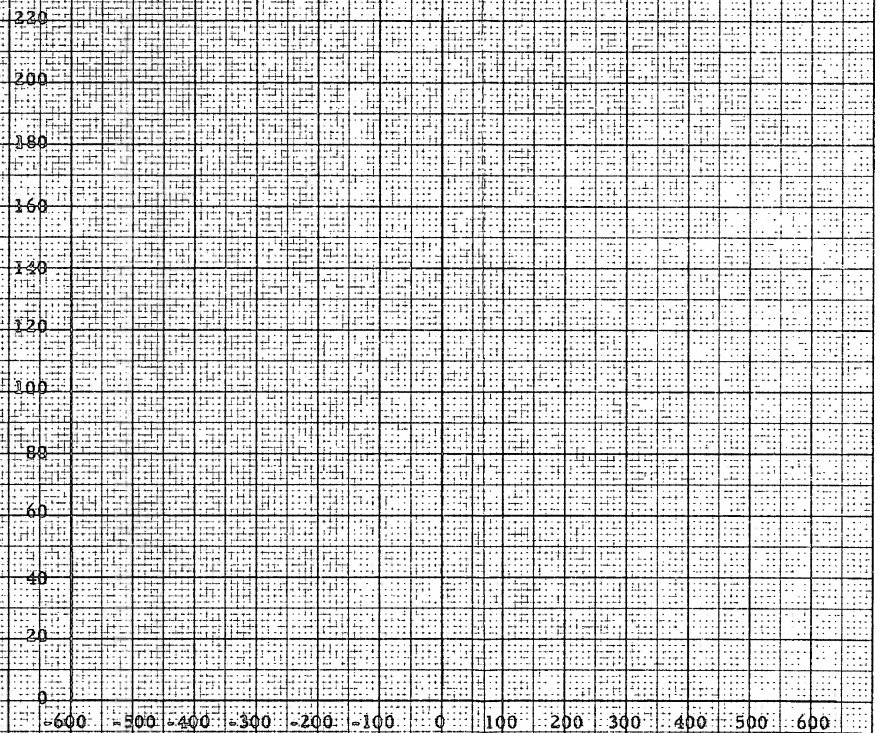
AFTER TRANSFER

AS RECEIVED LIMITS

P_b	Total W_{f_t} ~ pph			Zone I W_{f_1} ~ pph		
psia	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
20	5240	5560	5880	4340	4600	4860
50	13100	13900	14700	10850	11500	12150
100	26200	27800	29400	21700	23000	24300
150	39400	41700	44000	32600	34500	36400
180	47200	50000	52800	39000	41400	43800

STANDARD LIMITS

P_b	Total W_{f_t} ~ pph			Zone I W_{f_1} ~ pph		
psia	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
20	5280	5560	5840	4360	4600	4840
50	13200	13900	14600	10900	11500	12100
100	26400	27800	29200	21800	23000	24200
150	39600	41700	43800	32700	34500	36300
180	47400	50000	52600	39300	41400	43600



3-6-62

FIGURE 6

MAXIMUM RATIO CALIBRATION - BLEEDS CLOSED

SECTION 3.3.6

COMPRESSOR INLET TEMPERATURE SENSE CALIBRATION

T_{T_1} = 100° ± 5°F, T_{T_2} = as specified below, PD = 45 to 55 psig,
P_a = 235 to 255 psia, RΔP = 75 to 85 psig, Bleeds Reset = Bleeds Closed,
P_{LA} = 120°, P_B as shown in table.

Record: P_{LA}, P_b, W_{f_1}, W_{f_t}, T_{f_1}, T_{f_2}, T_1, T_{T_2}, P_o, P_1, P_2, RΔP, TVΔP, and Bleed Reset Position.

Limits: W_{f_1} and W_{f_t} as shown in applicable table below.

T_{T_2} = -65° F

AS RECEIVED LIMITS

P_b	Total W_{f_t} ~ pph			Zone I W_{f_1} ~ pph		
psia	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
20	6900	7400	7800	4340	4600	4860
60	22200	23540	24900	13050	13800	14550
100	38300	40600	42800	21700	23000	24300
150	54400	57700	61000	32600	34500	36400
180	56400	59800	63200	39000	41400	43800

STANDARD LIMITS

P_b	Total W_{f_t} ~ pph			Zone I W_{f_1} ~ pph		
psia	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
20	7020	7400	7730	4360	4600	4840
60	22200	23540	24700	13100	13800	14500
100	38500	40600	42600	21800	23000	24200
150	54800	57700	60600	32700	34500	36300
180	56800	59800	62800	39300	41400	43600

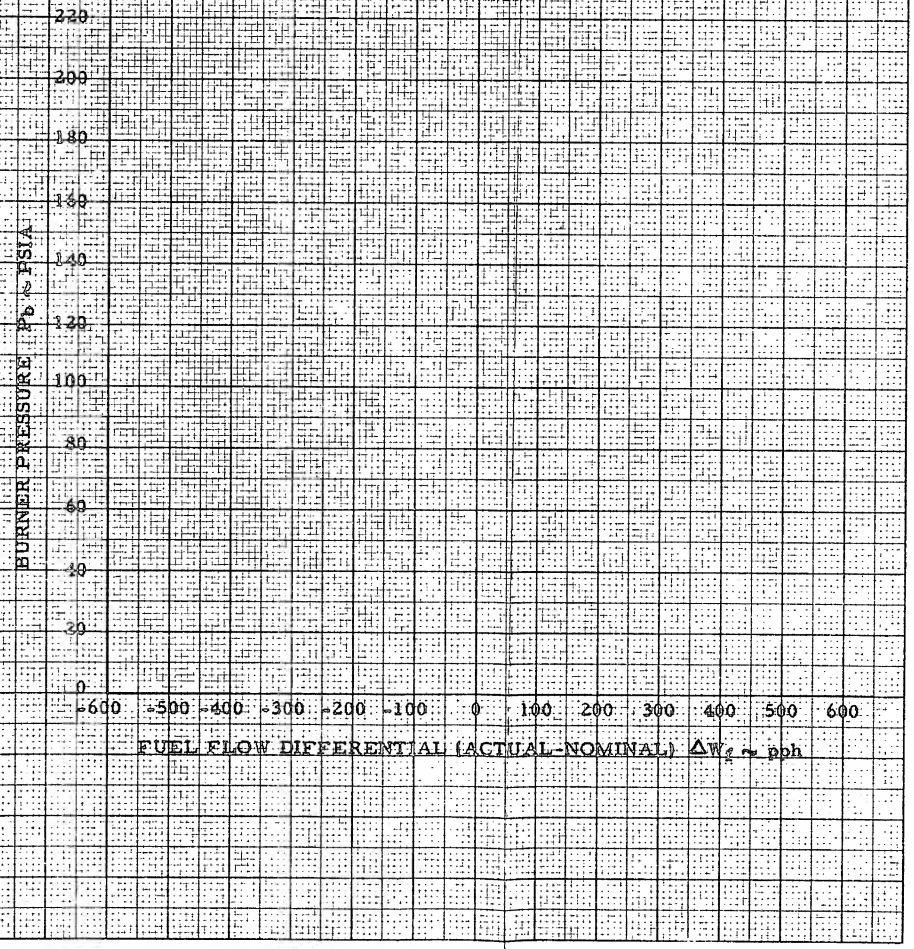
T_{T_2} = 150° F

AS RECEIVED LIMITS

P_b	Total W_{f_t} ~ pph			Zone I W_{f_1} ~ pph		
psia	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
20	6140	6500	6860	4340	4600	4860
60	18350	19450	20600	13050	13800	14550
100	32000	33900	35800	21700	23000	24300
150	46200	48900	51600	32600	34500	36400
180	54800	58100	61400	39000	41400	43800

STANDARD LIMITS

P_b	Total W_{f_t} ~ pph			Zone I W_{f_1} ~ pph		
psia	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
20	6150	6500	6840	4360	4600	4840
60	18450	19450	20500	13100	13800	14500
100	32200	33900	35600	21800	23000	24200
150	46400	48900	51400	32700	34500	36300
180	55200	58100	61000	39300	41400	43600



3-6-62

FIGURE 7

MAXIMUM RATIO CALIBRATION

SECTION 3.3.6

COMPRESSOR INLET TEMPERATURE SENSE CALIBRATION

T_1 = 100° ± 5°F, TT_2 = as specified below, P_D = 45 to 55 psig, Pa = 235 to 255 psia, RΔP = 75 to 85 psig, Bleeds Reset = Bleeds Closed, PLA = 120° as shown in table.

Record: PLA, P_b, W_{f_1}, W_{f_t}, T_{t_1}, T_{t_2}, T_1, TT_2, P_o, P_1, P_a, RΔP, TVΔP, and Bleed Reset Position.

Limits: W_{f_1} and W_{f_t} as shown in applicable table below.

TT_2 = 300°F Bleeds Closed

AS RECEIVED LIMITS

P_b	Total W_{f_t} ~ pph			Zone I W_{f_1} ~ pph		
psia	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
20	6440	6830	7220	4340	4600	4860
60	19450	20570	21700	13050	13800	14550
100	32300	34250	36200	21700	23000	24300
150	48000	50750	53600	32600	34500	36400
180	56400	59700	63000	39000	41400	43800

STANDARD LIMITS

P_b	Total W_{f_t} ~ pph			Zone I W_{f_1} ~ pph		
psia	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
20	6480	6830	7180	4360	4600	4840
60	19550	20570	21600	13100	13800	14500
100	32500	34250	36000	21800	23000	24200
150	48200	50750	53400	32700	34500	36300
180	56600	59700	62800	39300	41800	43600

TT_2 = 300°F Bleeds Open

AS RECEIVED LIMITS

P_b	Total W_{f_t} ~ pph			Zone I W_{f_t} ~ pph		
psia	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
20						
60						
100	The observed flow reading shall be 19% to 21% higher than the observed flow reading for TT_2 = 300°F bleeds closed for As Received Limits.					
150						
180						

STANDARD LIMITS

P_b	Total W_{f_t} ~ pph			Zone I W_{f_1} ~ pph		
psia	Minimum	Nominal	Maximum	Minimum	Nominal	Maximum
20						
60						
100	The observed flow reading shall be 19% to 21% higher than the observed flow reading for TT_2 = 300°F bleeds closed for Standard Limits.					
150						
180						

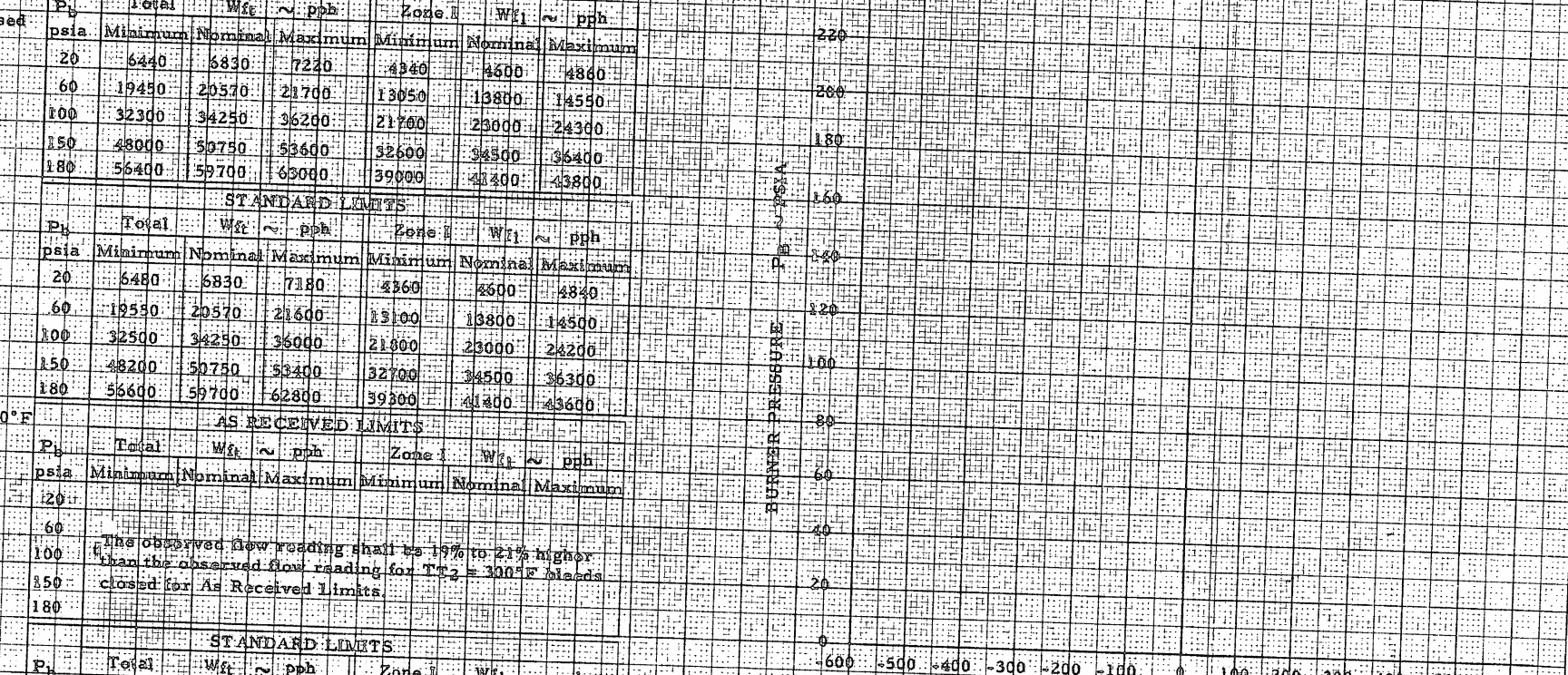


FIGURE 8

3-6-62

/ CCS No. J-4

MAXIMUM RATIO CALIBRATION - BLEEDS OPEN

SECTION 3.3.6

COMPRESSOR INLET TEMPERATURES SENSE CALIBRATION

$T_1 = 100° \pm 5°F$, $TT_2 = 750° \pm 2°F$, P_D = 45 to 55 psig, P_a = 235 to 255 psia, $R\Delta P$ = 75 to 85 psig, Bleeds Reset = Bleeds Open, PLA = 120°, P_b as shown in table.

Record: PLA, P_b, W_{f1}, W_{ft}, T_{f1}, T_{f2}, T_1, TT_2, P_D, P_1, P_a, $R\Delta P$, $TV\Delta P$, and Bleed Reset Position.

Limits: W_{f1} and W_{ft} as shown in applicable table below.

$TT_2 = 550°F$

AS RECEIVED LIMITS

P_b psia	Total W_{ft} ~ pph Minimum	Nominal	Maximum	Zone I W_{f1} ~ pph Minimum	Nominal	Maximum
20	7700	8160	8600	4340	4600	4860
60	26300	27330	28300	13050	13800	14550
100	43000	45600	48200	21700	23000	24300
150	56600	60000	63400	32600	34500	36400
180	56600	60000	63400	39000	41400	43800

STANDARD LIMITS

P_b psia	Total W_{ft} ~ pph Minimum	Nominal	Maximum	Zone I W_{f1} ~ pph Minimum	Nominal	Maximum
20	7740	8160	8600	4360	4600	4840
60	26300	27330	28300	13100	13800	14500
100	43200	45600	48000	21800	23000	24200
150	57000	60000	63000	32700	34500	36300
180	57000	60000	63000	39300	41400	43600

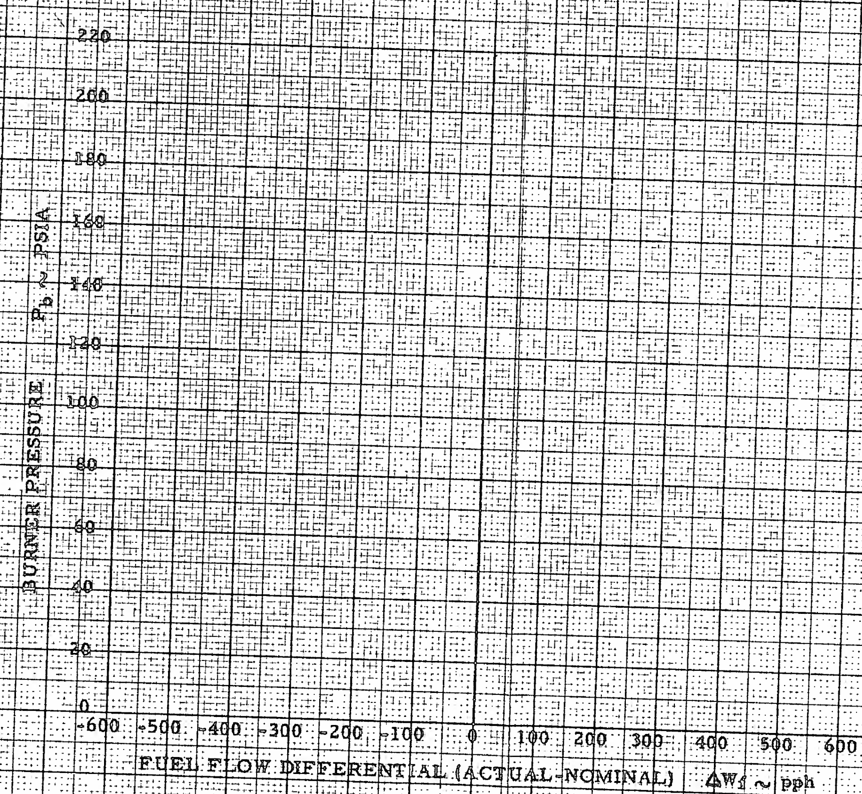
$TT_2 = 750°F$

AS RECEIVED LIMITS

P_b psia	Total W_{ft} ~ pph Minimum	Nominal	Maximum	Zone I W_{f1} ~ pph Minimum	Nominal	Maximum
20	7480	7920	8350	4340	4600	4860
30	11900	12300	12700	6520	6900	7280
50	20700	21600	22500	10850	11500	12150
100	40400	42756	45200	21700	23000	24300
150	49200	52200	55200	32600	34500	36400
180	56600	60000	63400	39000	41400	43800

STANDARD LIMITS

P_b psia	Total W_{ft} ~ pph Minimum	Nominal	Maximum	Zone I W_{f1} ~ pph Minimum	Nominal	Maximum
20	7520	7920	8350	4360	4600	4840
30	12000	12300	12600	6540	6900	7260
50	20800	21600	22400	10900	11500	12100
100	40600	42756	45000	21800	23000	24200
150	49600	52200	54800	32700	34500	36300
180	57000	60000	63000	39300	41400	43600



3-6-62

FIGURE 9

 ATE

This Schedule Is Applicable For
Vendors When Referenced in PWA
Purchase Specification Or Directed
by PWA Engineering

CCS No. J-15
Page 1

PRATT & WHITNEY AIRCRAFT
FLORIDA RESEARCH AND DEVELOPMENT CENTER

COMPONENT CALIBRATION SCHEDULE
FOR
MAIN FUEL CONTROL, P&WA P/N 2053632
(HSD MFC-47, P/N HS571460)
FOR
J58 (JT11) ENGINES

1. QUANTITY TO BE TESTED

1.1 100% of the PWA P/N 2053632 main fuel controls shall be bench tested at P&WA.

2. GENERAL REQUIREMENTS

2.1 Equipment Requirements

2.1.1 Flowbench capable of supplying at least 1000 to 40,000 pph of fuel flow at pressures up to 1000 psig and containing an accessory drive with a variable speed range of 200 to 5000 rpm. The drive motor power rating shall be at least 110 horsepower.

2.1.2 Hoist to be used for mounting and demounting the main fuel control and pump on the flowbench. The hoist shall be capable of lifting 250 pounds.

2.1.3 Boost pump and pressure regulator capable of maintaining 30 ± 5 psig fuel pressure at the inlet to the main pump over a total fuel flow range of 1000 to 40,000 pph.

2.1.4 JT11D-20 pump that meets the flow requirements of the applicable Component Calibration Schedule.

2.1.5 Pneumatic pressure source and regulator for simulating engine burner pressure; capable of supplying and maintaining any pressure between 2 and 200 psia.

2.1.6 Pneumatic pressure source and regulator for simulating engine compressor inlet total pressure; capable of supplying and maintaining any pressure between 1.5 and 50 psia.

Issued: 10-6-61
Revised: 2-14-62

2.1.7 Controllable temperature apparatus for simulating engine compressor inlet temperature (T_{t2}), capable of providing constant temperatures of -65° ± 2°F, 0° ± 2°F, 59° ± 2°F, 140° ± 2°F, 250° ± 3°F, and 750° ± 10°F.

2.1.8 Fuel nozzle and burner pressure simulators to establish and maintain control discharge pressure. These simulators must meet the requirements shown on figure 1.

2.1.9 Heat exchanger to maintain the fuel temperature at the flowmeter inlet and main fuel pump inlet to 100° ± 5°F.

2.1.10 Torque measuring equipment to measure power lever torque of at least 5 to 40 inch-pound range with an accuracy of ± 2 inch-pounds within this range.

2.1.11 Torque measuring equipment to measure compressor bypass bleed output shaft torque of at least 5 to 100 inch-pound range with an accuracy of ± 2 inch-pounds within this range.

2.1.12 Protractor to measure power lever angle with a range of 0° to 125° and divided into a least 1° increments. With the protractor installed on the control and moved to any scale division, the control lever shall be positioned with an accuracy of ± 1/2° of indicated reading.

2.1.13 A 0.0920" to 0.0945" diameter pin to measure the location of the control power lever index holes.

2.1.14 Protractor to measure compressor bypass bleed output shaft angle with a range of at least 0° to 65° and divided into a least 1° increments.

2.1.15 Hydraulic pressure source to check the control transducer valve. This source shall be supplied to the orifice block of paragraph 2.1.16 and be capable of maintaining 2000 ± 10 psi differential pressure above main pump inlet pressure over a flow range of 500 to 1500 pph. (PWA P/N 2053699 pressure regulating valve or equivalent may be used with a 3000 psig supply.)

2.1.16 Orifice block containing an orifice having a flow rate of 880 ± 10 pph at 1000 psi pressure drop using PMC 9073 fluid.

2.1.17 Electrical source of 208 volt, 3 phase, 400 cycle, and maximum amperage of 1.3 amperes to supply power to adjust the Military trimmer. (Refer to figure 2.)

2.1.18 Instrumentation capable of taking the measurements listed below with the accuracy specified:

NOTE

Only three 50 to 1000 psig gages will be required to measure C_i, C_d C_{ab}, C_{wm}, and C_{so}

a. N_p - (pump drive speed, of at least 100 to 5000 rpm speed range with an accuracy of ± 2 rpm

b. W_f - (metered fuel flow, of at least 1000 to 40,000 pph flow range with an accuracy of ± 1/2% of indicated reading within this range

c. P_b - (burner pressure) of at least 2 to 220 psia pressure range with an accuracy of ± 0.3 psia of indicated reading from 2 to 60 psia and at least ± 0.5% of indicated reading from 60 to 220 psia

d. T_{t2} - (compressor inlet temperature) of at least -70° to +750°F temperature range with an accuracy of ± 2°F of indicated range from -70° to +145°F and ± 5°F from +145° to +750°F

e. P_o - (pump inlet pressure) of at least 5 to 100 psig pressure range with an accuracy of ± 1 psig within this range

f. C_i - (control inlet pressure) of at least 50 to 1000 psig pressure range with an accuracy of ± 10 psig within this range.

g. C_d - (control discharge pressure) of at least 50 to 1000 psig pressure range with an accuracy of ± 10 psig within this range

h. C_b - (control body pressure) of at least 20 to 200 psig pressure range with an accuracy of ± 2 psig within this range.

i. C_{ab} - (afterburner arming signal pressure) of at least 50 to 1000 psig pressure range with an accuracy of ± 15 psig within this range

j. C_{wm} - (windmill bypass valve signal pressure) of at least 50 to 1000 psig pressure range with an accuracy of ± 15 psig within this range.

k. C_{so} - (shutoff valve signal pressure) of at least 50 to 1000 psig pressure range with an accuracy of ± 15 psig within this range.

l. P_{t2} - (compressor inlet pressure) of at least 10 to 55 psia pressure range with an accuracy of ± 0.3 psia within this range.

m. P_t - (hydraulic transmission line pressure) of at least 100 to 2500 psig pressure range with an accuracy of ± 10 psig within this range.

n. P_h - (regulated hydraulic pressure) of at least 100 to 2500 psig pressure range with an accuracy of ± 10 psig within this range.

o. $MV\Delta P$ - (metering valve differential pressure) of at least 10 to 60 psid pressure range with an accuracy of ± 0.5 psi within this range.

p. T_{f1} - (test fluid temperature measured at the flowmeter inlet) of at least 70° to 120°F temperature range with an accuracy of ± 2°F within this range.

q. T_{f2} - (main fuel pump inlet fuel temperature) of at least 70° to 120°F temperature range with an accuracy of ± 2°F within this range.

2.2 Test Fluid

Test fluid shall be PMC 9073.

2.3 Depreservation

If the control has been preserved with flushing oil, it must be depreserved in accordance with Engineering Instruction No. 125.

2.4 Installation

The control shall be mounted on the flowbench in the test position shown on figure 3.

2.5 Data to be Recorded

2.5.1 The following data shall be recorded on each data sheet:

a. PWA part number and change letter
b. Control serial number
c. HSD parts list and revision number
d. Test fluid type

2.5.2 The following data shall be recorded at each calibration point:

N_p, W_f, P_b, T_{t2}, T_{f1}, and PLA

2.5.3 The following data shall be recorded when noted in the calibration procedure:

P_o, C_i, C_d, C_b, C_{ab}, C_{wm}, C_{so}, P_{t2}, P_t, P_h, $MV\Delta P$, and T_{f2}.

3. TEST REQUIREMENTS

3.1 Applicable Limits

3.1.1 As received limits shall be used for all controls received from the vendor whether run with or without adjustment.

3.2 General Requirements

3.2.1 The following conditions shall be maintained unless specified otherwise:

T_{f1} = 100° ± 5°F

T_{t2} = 59° ± 2°F

P_{t2} = 15 ± 0.5 psia

P_o = 30 ± 5 psig

Stand plumbing shall be as shown on figure 4.

3.2.2 The complete calibration shall be performed prior to any adjustments except as specified in section 3.3.13.

3.2.3 Only the adjustments listed below will be allowed during the calibration. If adjustments are made, (except as noted in section 3.3.13) the applicable sections of the CCS must be rerun.

3.2.3.1 Adjustment - Metering Valve ΔP. (MVΔP)

Applicable sections: 3 3.5, 3.3.6, 3.3.7, 3.3.10 1, 3.3.10.2, 3.3.10.3, 3.3.11, and 3.3.13.

3.2.3.2 Adjustment - Military Trimmer

Applicable sections: 3.3.6, 3.3.10.1, and 3.3.10 2.

3.2.3.3 Adjustment - Idle Trimmer

Applicable sections: 3 3.6, 3.3.10.1, and 3.3.10 2.

3.2,4 All test conditions shall be set by approaching the test point of the variable in the direction indicated. Any overshoot or undershoot shall require that the portion of the calibration from the maximum or minimum condition be repeated.

3.2.5 Unless otherwise specified; all test points shall be set using burner pressure (P_b) measured at the P_b supply connection to the control and identified as P_b in 2.1.18. The P_b gage must be set at least once every shift to read barometric pressure with the gage line removed from the control or pressure source.

3.2.6 Although not specifically shown in the limits of each section, the following limit applies to each section of the test procedure.

Limits: There shall be no external leakage other than an allowable leakage of 30 drops per minute from the overboard drain connection.

3.2.7 Fuel flow limits specified are absolute values. Observed fuel flows shall be corrected in accordance with the most recent production test flow measurement correction curves.

3.3 Test Procedure

Order of calibration may be varied as desired after completion of sections 3.3.1 and 3.3.2 except for sections 3.3.13 and 3.3.14 which must be the last items performed.

3.3.1 Indexing

3.3.1.1 Install the power lever protractor and set it to zero degrees (0°) with the control stop plate held against the shutoff stop on the index plate (full clockwise) with a torque of 10 pound-inches.

3.3.1.2 The Idle and Military PLA specified in subsequent sections shall be set to the following values:

Idle: 14° to 16° PLA
Military: 62° to 64° PLA

3.3.2 Control Exercise (data need not be recorded)

3.3.2.1 Operate the control for at least five minutes at Military PLA, 3400 rpm N_p, and 150 psia P_b.

3.3.2.2 At Military PLA and 15 psia P_b, vary N_p from 0 to 4000 rpm, without overshoot, at least three times at approximately 30 seconds per cycle.

3.3.2.3 At Military PLA and 3400 rpm N_p, vary P_b from 15 to 150 to 15 psia three times at approximately 30 seconds per cycle.

3.3.2.4 At 3400 rpm N_p and 100 psia P_b, vary PLA from 120° to 0° to 120° three times at approximately 30 seconds per cycle.

3.3.2.5 If the calibration is interrupted and the fuel in the control body is allowed to drain due to control disassembly, control removal, plumbing disconnection, etc., the control exercise specified in sections 3.3.2.1 through 3.3.2.4 shall be repeated.

3.3.3 Power Lever Torque

3.3.3.1 Set 120° PLA, 2200 rpm N_p, and 30 psia P_b. Measure maximum torque required to move to 65° PLA and then to 0° PLA. Measure maximum torque required to move from 0° to 65° PLA and then to 120° PLA.

Limits:	From 120° to 65° PLA	5 in-lbs max.
	From 65° to 0° PLA	25 in-lbs max.
	From 0° to 65° PLA	25 in-lbs max.
	From 65° to 120° PLA	5 in-lbs max.

3.3.4 Power Lever Sequence

3.3.4.1 Military

Set the following conditions: 120° PLA, 4000 rpm N_p, and 100 psia P_b.

3.3.4.1.1 Record W_f

Slowly decrease PLA to 62° and note maximum W_f variation from value noted at 120° PLA.

Limits: ± 75 pph

3.3.4.1.2 Record Wf at 62° PLA

Slowly decrease PLA and note PLA at which Wf begins to drop below value noted at 62° PLA.

Limits: 58° to 60° PLA

3.3.4.2 Idle

Set the following conditions: 13° PLA. 2080 rpm N_p, and 25 psia P_b.

3.3.4.2.1 Record Wf

Slowly increase PLA and note PLA at which W_f begins to increase above W_f value recorded above.

Limits: 15° PLA minimum

3.3.4.3 Recirculating and Shutoff Signals

3.3.4.3.1 Set 15° PLA, 2100 ± 50 rpm N_p, and 50 psia P_b. Decrease PLA to 12°. Record C_{wm} and C_i

Limits: C_{wm} shall be within 40 psi of C_i.

3.3.4.3.2 Decrease PLA until C_{wm} is within 50 psi of C_b. Record PLA.

Limits: 8° to 11° PLA

3.3.4.3.3 Decrease PLA to 7°. Record C_{wm} and C_{so}.

Limits: C_{wm} and C_{so} must be within 50 psi of C_b

3.3.4.3.4 Decrease PLA until C_{so} starts to increase above value recorded at 7° PLA. Record PLA.

Limits: 3° to 6° PLA

3.3.4.3.5 Decrease PLA until P_{so} is within 40 psi of Ci. Record PLA.

Limits: 2° minimum PLA.

3.3.5 Burner Pressure Sense Calibration and Minimum Flow

3.3.5.1 Maximum Line

Set conditions and record the specified data as shown on figure 5

Limits: As specified on figure 5

3.3.5.2 Minimum Line

Set conditions and record the specified data as shown on figure 6.

Limits: As specified on figure 6.

3.3.5.3 Minimum Flow

Set conditions and record the specified data as shown on figure 6.

Limits: As specified on figure 6.

3.3.6 Governor Setting

3.3.6.1 Military and Idle Droop Lines

Set conditions and record data as specified on figure 7.

Limits: As shown on figure 7

3.3.7 Starting Schedule

Set conditions and record data as specified on figure 8

Limits: As shown on figure 8

3.3.8 Acceleration and Topping Schedules

3.3.8.1 Set conditions and record data as specified on figure 9.

Limits: As shown on figure 9

3.3.9 Compressor Bleed Bypass System

3.3.9.1 Set the following conditions: 75° PLA 50 psia P_b, and 59° Tt2. Slowly increase Np from 0 rpm and record Np at which the compressor bypass bleed shaft rotates clockwise

Limits: 245 rpm maximum

3.3.9.2 Set the following conditions: 15° PLA, 5 psia P_b, 3500 rpm Np, and 59° Tt2. Decrease PLA to 0° and then decrease speed to 20 rpm below speed at which the compressor bypass bleed shaft rotates clockwise. Apply a maximum torque of 75 pound-inches in an attempt to rotate the compressor bypass bleed counterclockwise

Limits: Shaft must not rotate counterclockwise at 75 pound-inches torque.

3.3.9.3 Set the following conditions: 65° PLA, 50 psia Pb, and 2000 rpm Np Increase Np until the compressor bypass bleed shaft rotates counterclockwise. Measure angle of rotation

Limits: Shaft must rotate 58° to 60°

3.3.10 Temperature Bias

The control temperature sense bulb must be brought to the specified temperature without overshoot and then stabilized at each specific temperature for at least five minutes before setting the test point.

3.3.10.1 Military Droop

Set conditions and record data as specified on figure 10.

Limits: As shown on figure 10

3.3.10.2 Idle Droop

Set conditions and record data as specified on figure 10.

Limits: As shown on figure 10

3.3.10.3 Acceleration Limit Schedule

Set conditions and record data as specified on figure 11.

Limits: As shown on figure 11.

3.3.10.4 Military Set Speed and A/B Arming Signal

Set conditions and record data as specified on figure 12.

Limits: As shown on figure 12.

3.3.10.4.1 To define Military set speed, increase speed slowly from 3800 rpm Np and note the speed at which $P_t - P_o$ begins to drop sharply. This pressure drop should occur from a $P_t - P_o$ of greater than 1820 psi to a $P_t - P_o$ of below 620 psi, without further increase in Np. This is defined as "Military Set Speed". To check hysteresis, decrease Np from a speed of 150 rpm greater than the military set speed, found by increasing rpm, until $P_t - P_o$ increases sharply. This pressure rise should occur from a Pt - Po below 620 psi to a Pt - Po greater than 1820 psi, without further decrease in Np.

3.3.10.4.2 To define A/B arming signal, increase Np until P_{ab} is within 150 ± 5 psi of pump inlet. Record this Np.

3.3.10.5 Compressor Bypass Bleed System

Set conditions and record data as specified on figure 13.

Limits: As shown on figure 13.

3.3.11 Burner Pressure Limiter

Set conditions and record data as specified on figure 14.

Limits: As shown on figure 14.

3.3.12 Control Discharge Pressure Sensitivity

Connect control discharge to a hand valve. Set conditions and record data as specified on figure 15.

Limits: As shown on figure 15.

3.3.13 Military and Idle Trim Range

3.3.13.1 Military Trim Range

Set conditions. Record "As Received" data before making any adjustments. Adjust control (adjustments to be made with remote trimmer) and record data as shown on figure 16.

Limits: As shown on figure 16.

3.3.13.2 Idle Trim Range

Set conditions. Record "As Received" data before making any adjustments. Adjust control (adjustments to be made manually) and record data as shown on figure 16.

3.3.13.3 Military and Idle Trim Points

Trim Military and Idle set points and record data as specified on figure 16. The following trimming procedure shall be used:

3.3.13.3.1 Set points shall be set by approaching the trim speed, without overshoot, from a speed of at least 200 rpm lower than the trim speed.

3.3.13.3.2 Hysteresis checks shall be made by approaching the trim speed, without overshoot, from a speed of at least 200 rpm higher than the trim speed.

3.3.13.3.3 Military shall be trimmed by using the remote trimmer over-ride adjusting screw, with the remote trimmer actuated to midrange.

3.3.13.3.4 Any adjustment to Military fuel flow shall require a recheck of Idle flow to determine if any adjustment of Idle flow will be required. Similarly, any adjustment of Idle flow will require a recheck of Military fuel flow. No set point data shall be recorded as final unless both the Military and Idle set points are within limits.

3.3.14 Leakage Check

3.3.14.1 Set 60° PLA, 100 psia Pb, and 3400 rpm Np. Measure overboard drain leakage and inspect control for external leakage. Record overboard drain leakage in drops per minute and locations of any external leakage.

Limits: Overboard drain leakage - 20 drops per minute.
No external leakage.

3.3.14.2 At 200 psia Pb, leak check the burner pressure limiter to burner pressure sense line with a soapy water solution. Final leak check shall be made with the control line connector nuts lockwired.

Limits: No leakage.

3.3.15 Preservation and Storage

After completion of testing, the control shall be drained of fuel and prepared for storage in accordance with Engineering Instruction No. 125. Protective covers and containers shall be used to prevent damage or contamination of the control.

3.3.16 Applicable Figures

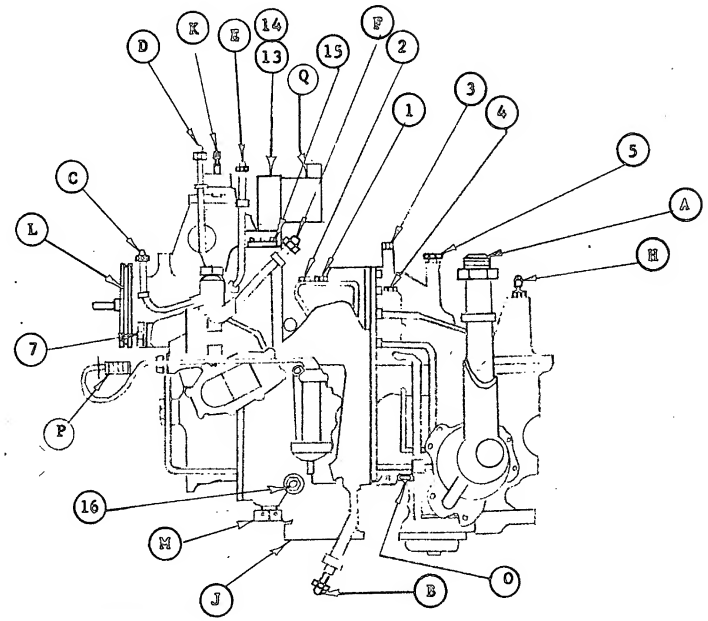
Figure 1	Control Discharge Pressure Schedule	2-14-62
Figure 2	Remote Trimmer Electrical Schematic	2-14-62
Figure 3	Port Identification and Test Position	2-14-62
Figure 4	Main Fuel Control Schematic Diagram	2-14-62
Figure 5	Burner Pressure Sense Calibration - Maximum Line	2-14-62
Figure 6	Burner Pressure Sense Calibration - Minimum Line and Minimum Flow	2-14-62
Figure 7	Military and Idle Droop Lines	2-14-62
Figure 8	Starting Schedule	2-14-62
Figure 9	Acceleration and Topping Schedules	2-14-62
Figure 10	Temperature Bias - Military and Idle	2-14-62
Figure 11	Temperature Bias - Acceleration Limit Schedule	2-14-62
Figure 12	Temperature Bias - Military Set Speed and A/B Arming Signal	2-14-62

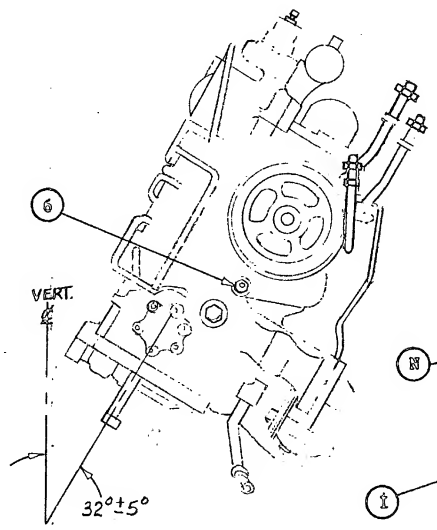
Figure 13	Temperature Bias - Compressor Bypass Bleed System	2-14-62
Figure 14	Burner Pressure Limiter	2-14-62
Figure 15	Discharge Pressure Sensitivity	2-14-62
Figure 16	Military and Idle Trim Range - Military and Idle Trim Points	2-14-62

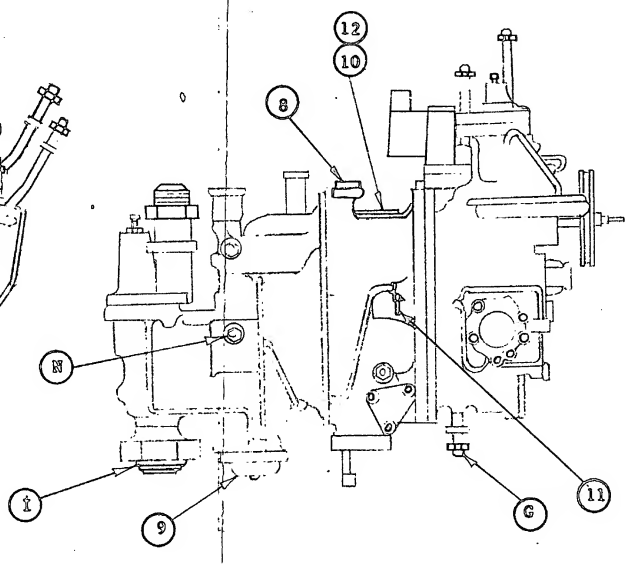
Issued: 10-6-61
Revised: 2-14-62

Approved:

STAT







CONNECTIONS & PRESSURE TAPS

A. CONTROL DISCHARGE
B. OVERBOARD DRAIN
C. HYDRAULIC RETURN
D. A/B DRAIN REFERENCE
E. A/B ARMING SIGNAL
F. TRANSMISSION LINE
G. COMPRESSOR INLET PRESSURE
H. BURNER PRESSURE
I. CONTROL INLET
J. CONTROL RETURN
K. COMPRESSOR BLEED SHAFT
L. POWER LEVER
M. BODY PRESSURE
N. METERING VALVE UPSTREAM
O. METERING VALVE DOWNSTREAM
P. COMPRESSOR INLET TEMPERATURE SENSE BULB
Q. REMOTE TRIMMER ELECTRICAL CONNECTOR

ADJUSTMENTS

1. TEMPERATURE SERVO POSITION ADJ.
2. TEMPERATURE SERVO RATE ADJ.
3. SPEED SERVO POSITION ADJ.
4. METERING VALVE ΔP SENSOR ADJ.
5. METERING VALVE MIN. FLOW ADJ.
6. INLET PRESSURE SERVO RATE ADJ.
7. INLET PRESSURE SERVO POSITION ADJ.
8. METERING VALVE TRIMMER ADJ.
9. METERING VALVE RATE ADJ.
10. SPEED SERVO RATE ADJ. (UNDER COVER)
11. P_b TRIMMER ADJ.
12. SEQUENCING VALVE ACCESS COVER
13. MILITARY W_f/P_b ADJ.
14. IDLE W_f/P_b ADJ.
15. INTEGRATING PISTON-PILOT VALVE
16. COMPRESSOR BLEED PILOT VALVE ADJ.

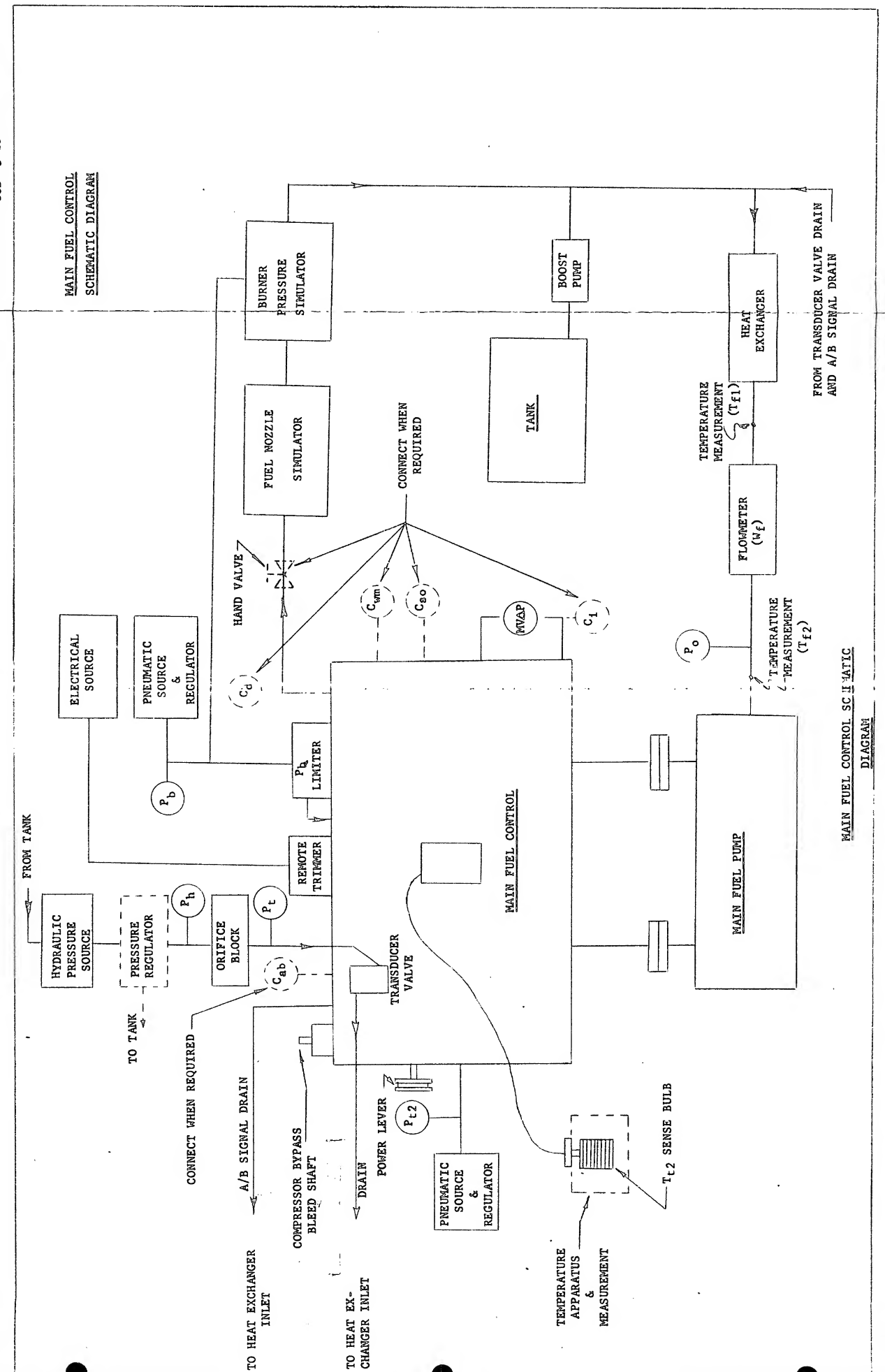
MAIN FUEL CONTROL
PORT IDENTIFICATION & TEST POSITION

2-14-62

FIGURE 3

Approved For Release 2009/07/08 : CIA-RDP67B00657R000100190001-9

CCS J-15



2-14-62

FIGURE 4

CCS J -15

BURNER PRESSURE SENSE

CALIBRATION

MAXIMUM LINE

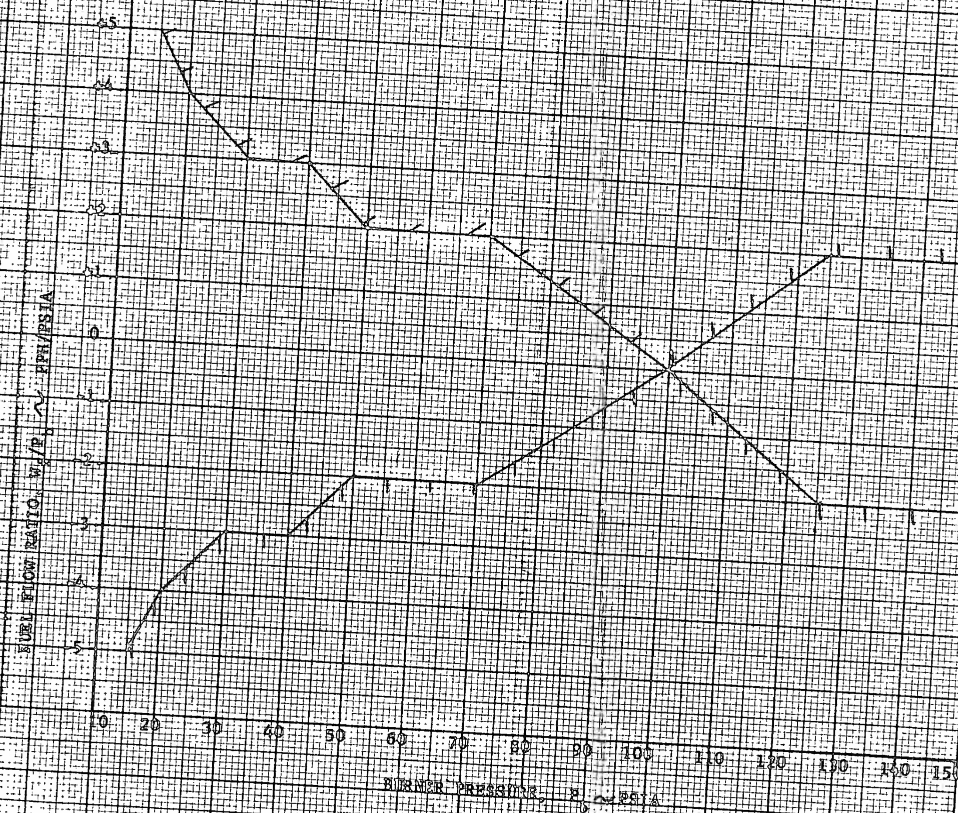
SET THE FOLLOWING CONDITIONS: 75° PLA, 3780 ± 10 RPM N_p, 59°T_2

SET P_b TO VALUES LISTED IN THE TABLE BELOW.

RECORD: W_f, NWΔP AT EACH POINT

CALCULATE: FUEL FLOW RATIO (W_f/P_b) AT EACH POINT AND RECORD

ITEM	DIRECTION OF P_b	P_b ~ PSIA	RECORD W_f ~ PPH	RECORD (W_f/P_b) PPH/PSIA	LIMITS (W_f/P_b) PPH/PSIA FROM ITEM 7	RECORD NWΔP PSID
1	INCREASING	15			± 5	
2		20			± 4	
3		30			± 3	
4		40			± 3	
5		50			± 2	
6		70			± 2	
7		100			—	
8		125			± 2	
9		150			± 2	
10	DECREASING	125			± 2	
11		70			± 2	
12		30			± 3	
13		20			± 4	



2-14-62

Approved For Release 2009/07/08 : CIA-RDP67B00657R000100190001-9

BURNER PRESSURE SENSE CALIBRATION

MINIMUM LINE AND MINIMUM FLOW

MINIMUM LINE

SET FOLLOWING CONDITIONS: 15° PLA, 3400±10 RPM N_G, 59°F T_{t_2}

SET P_b TO VALUES LISTED BELOW

RECORD W_f AND $W/\Delta P$ AT EACH POINT

DIRECTION P_b	P_b ~PSIA	RECORD W_f ~PPH	LIMITS FUEL FLOW~PPH	$W/\sqrt{\Delta P}$ ~PSID
INCREASING	15		1662 - 1759	
	30		1662 - 1759	
	40		1950 - 2211	
	60		2925 - 3316	
	100		4876 - 5528	
	150		7313 - 8291	
DECREASING	100		4876 - 5528	
	60		2925 - 3316	
	40		1950 - 2211	
	15		1662 - 1759	

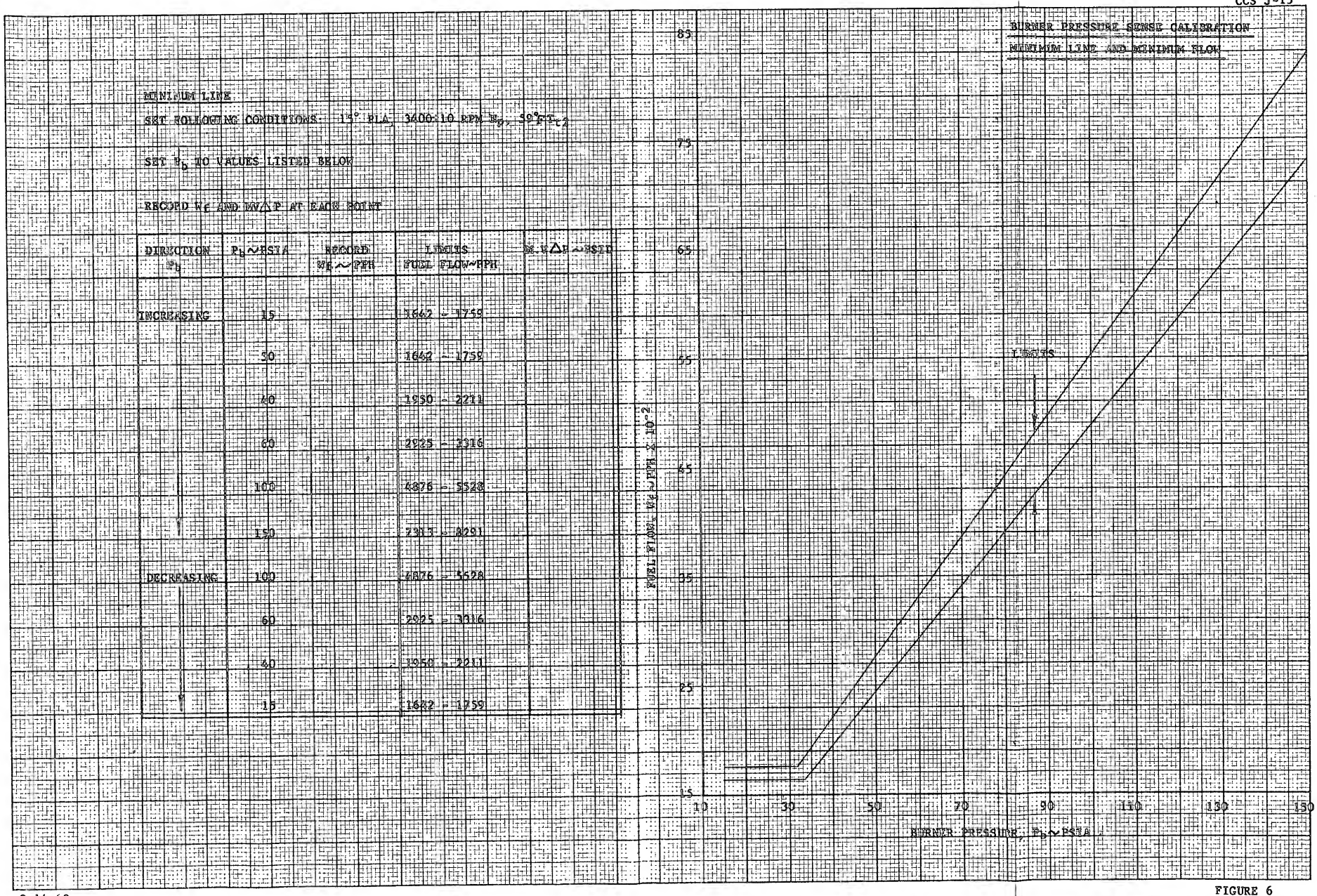


FIGURE 6

2-14-62

MILITARY DROOP LINE

SET THE FOLLOWING CONDITIONS: 55° PLA, 59°F T_{t2}, 110 PSIA P_b
SET N_p TO LISTED VALUES.
RECORD: W_f AND MVAP AT EACH POINT.

ITEM	$N_p \sim$ RPM	DIRECTION OF APPROACHING N_p	RECORD $W_f \sim$ PPH	LIMITS: $W_f \sim$ PPH	RECORD MVAP PSID
1	3925 ± 2	INCREASE		287-495 MORE THAN THE W_f RECORDED IN ITEM 3	
2	3979 ± 2			150-260 MORE THAN THE W_f RECORDED IN ITEM 3	
3	4040 ± 2			20,036 TO 20,567	
4	4094 ± 2			160-260 LESS THAN THE W_f RECORDED IN ITEM 3	
5	4135 ± 2			234-403 LESS THAN THE W_f RECORDED IN ITEM 3	
6	4040 ± 2	DECREASE		WITHIN ± 205 OF THE W_f RECORDED IN ITEM 3	

IDLE DROOP LINE

SET THE FOLLOWING CONDITIONS: 15° PLA, 59°F T_{t2}, 25 PSIA P_b
SET N_p TO LISTED VALUES
RECORD: W_f AND MVAP AT EACH POINT

ITEM	$N_p \sim$ RPM	DIRECTION OF APPROACHING N_p	RECORD $W_f \sim$ PPH	LIMITS: $W_f \sim$ PPH	RECORD MVAP PSID
1	2015 ± 2	INCREASE		726-1040 MORE THAN THE W_f RECORDED IN ITEM 2	
2	2080 ± 2			2668 TO 2693	
3	2140 ± 2			712-1020 LESS THAN THE W_f RECORDED IN ITEM 2	
4	2080 ± 2	DECREASE		WITHIN ± 200 OF THE W_f RECORDED IN ITEM 2	
5	2015 ± 2			WITHIN ± 200 OF THE W_f RECORDED IN ITEM 1	

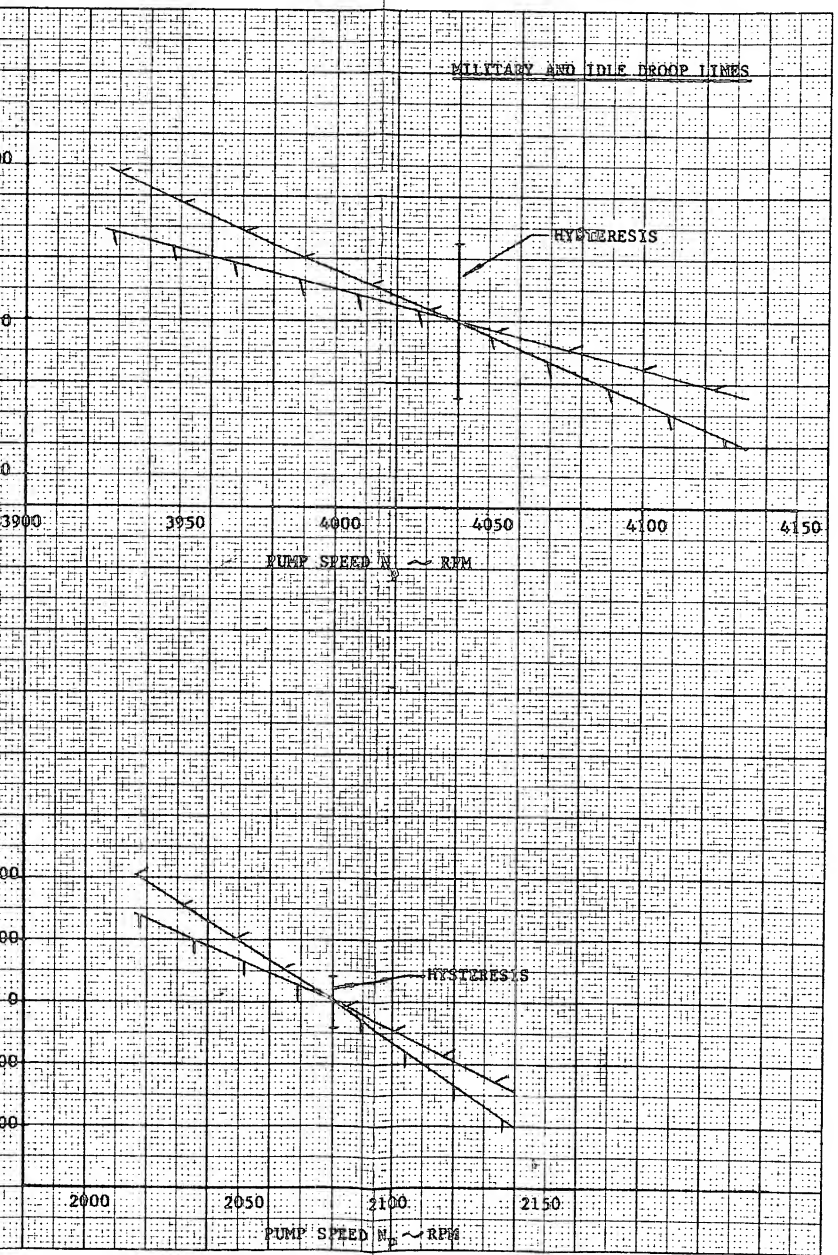


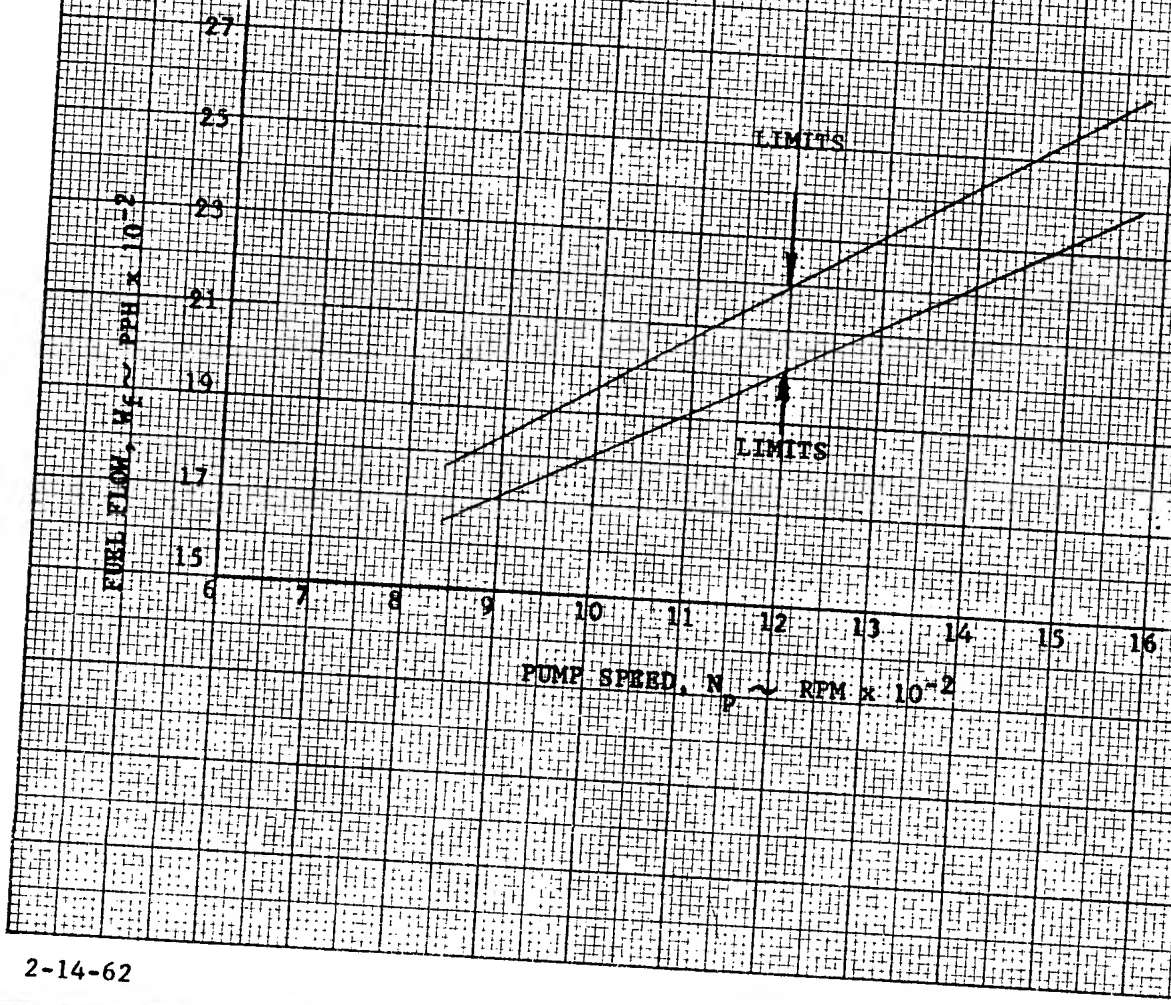
FIGURE 7

2-14-62

STARTING SCHEDULE

SET THE FOLLOWING CONDITIONS: 15° PLA, 59°F T_{t2}
SET P_b AND N_P TO VALUES LISTED BELOW.
RECORD; W_f AT EACH POINT

P_b PSIA	N_P RPM	RECORD $W_f \sim$ PPH	LIMITS $W_f \sim$ PPH
15.0	630 ± 2		RECORD 1642-1765
15.5	840 ± 2		
18.0	1260 ± 2		RECORD 2400-2685
21.0	1575 ± 2		



2-14-62

FIGURE 8

ACCELERATION AND TOPPING SCHEDULES

ACCELERATION SCHEDULE

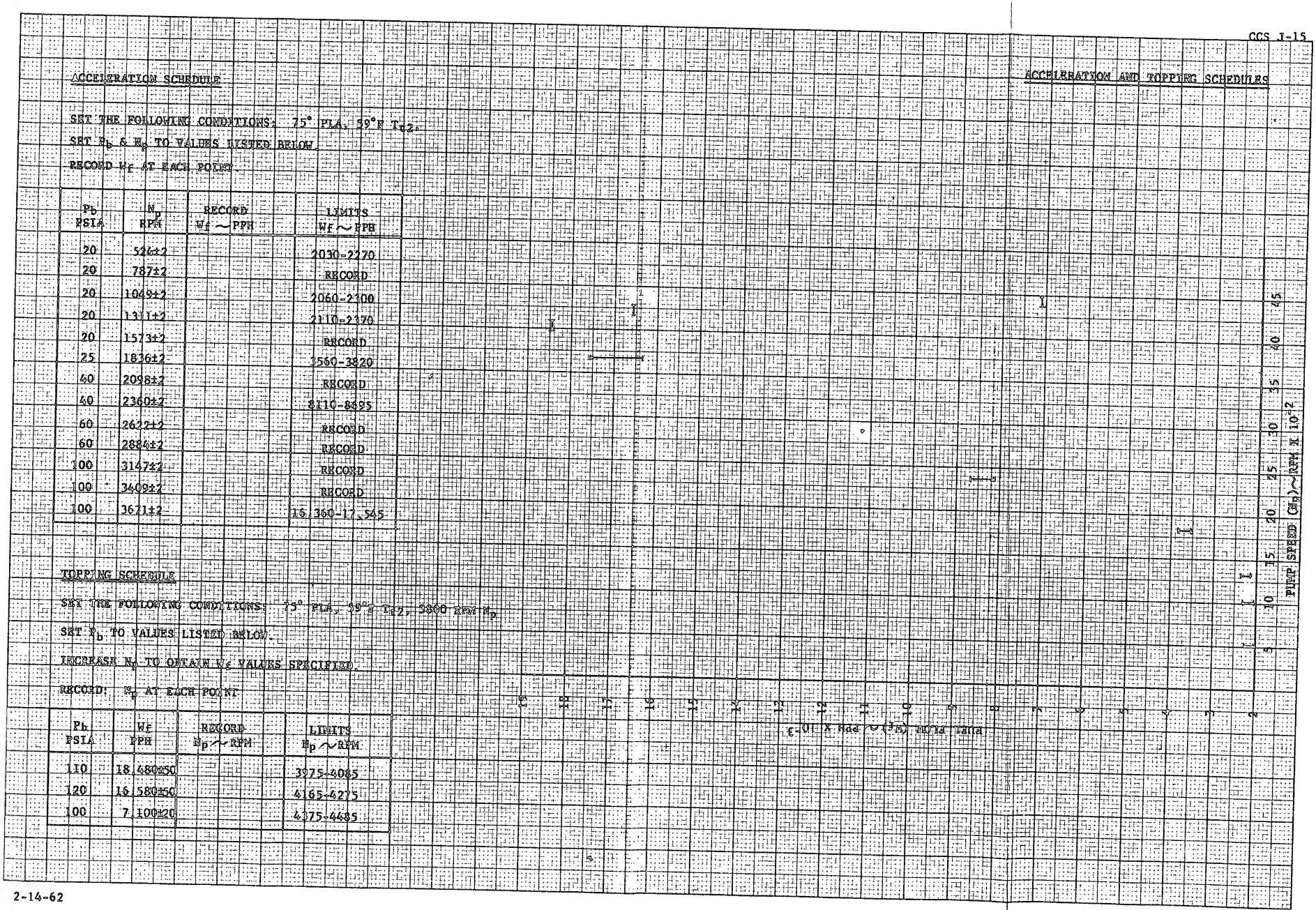
SET THE FOLLOWING CONDITIONS: 75° PLA, 59°F T_{t2}.
SET P_b & N_p TO VALUES LISTED BELOW.
RECORD W_f AT EACH POINT.

P_b PSIA	N_p RPM	RECORD W_f ~ PPH	LIMITS W_f ~ PPH
20	526±2		2030-2270
20	787±2		RECORD
20	1049±2		2060-2300
20	1311±2		2110-2370
20	1573±2		RECORD
25	1836±2		3560-3820
40	2098±2		RECORD
40	2360±2		8110-8695
60	2622±2		RECORD
60	2884±2		RECORD
100	3147±2		RECORD
100	3409±2		RECORD
100	3671±2		16,360-17,545

TOPPING SCHEDULE

SET THE FOLLOWING CONDITIONS: 75° PLA, 59° T_{t2}, 5800 RPM N_p
SET P_b TO VALUES LISTED BELOW.
INCREASE N_p TO OBTAIN W_f VALUES SPECIFIED.
RECORD: N_p AT EACH POINT

P_b PSIA	W_f PPH	RECORD N_p ~ RPM	LIMITS N_p ~ RPM
110	18,480±50		3975-4085
120	16,580±50		4165-4275
100	7,100±20		4375-4485



2-14-62

FIGURE 9

MILITARY

SET FOLLOWING CONDITIONS: 75° PLA, 4040 ± 2 RPM N_p.
SET T_{t2} AND P_b TO VALUES LISTED BELOW.
RECORD: W_f AT EACH POINT.

P_b PSIA	T_{t2} °F	RECORD $W_f \sim$ PPH	LIMITS: $W_f \sim$ PPH
120	-65		13,970-14,470
120	0		18,825-19,375
110	59		20,035-20,565
50	250		7,935- 8,165

IDLE

SET FOLLOWING CONDITIONS: 15° PLA, 25 PSIA P_b, 2080 ± 2 RPM N_p.
SET T_{t2} TO VALUES LISTED BELOW.
RECORD: W_f AT EACH POINT.

T_{t2} °F	RECORD $W_f \sim$ PPH	LIMITS $W_f \sim$ PPH
-65		1990-2210
0		2240-2460
59		2470-2695
140		2065-2285
250		2585-2815

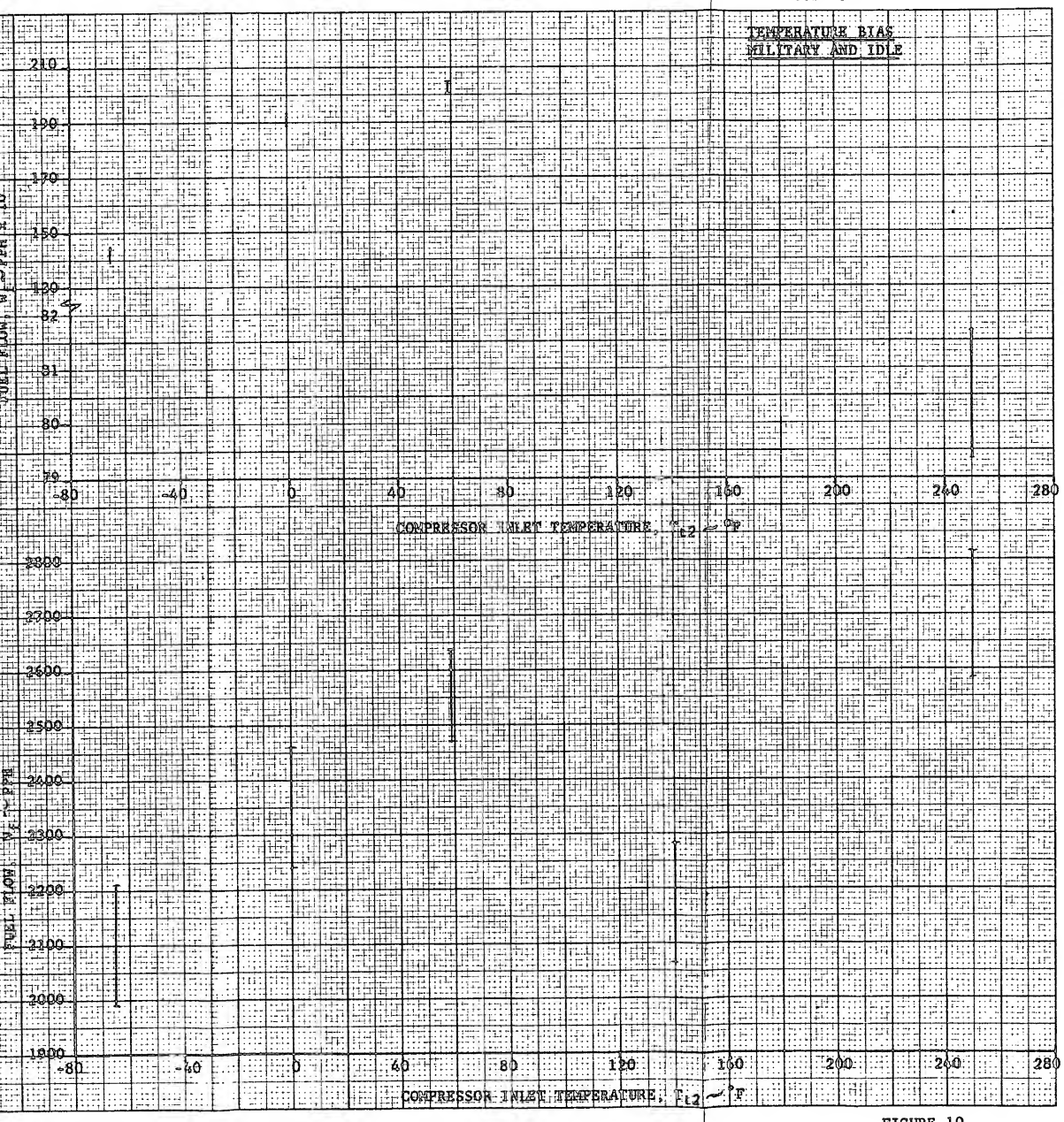


FIGURE 10

2-14-62

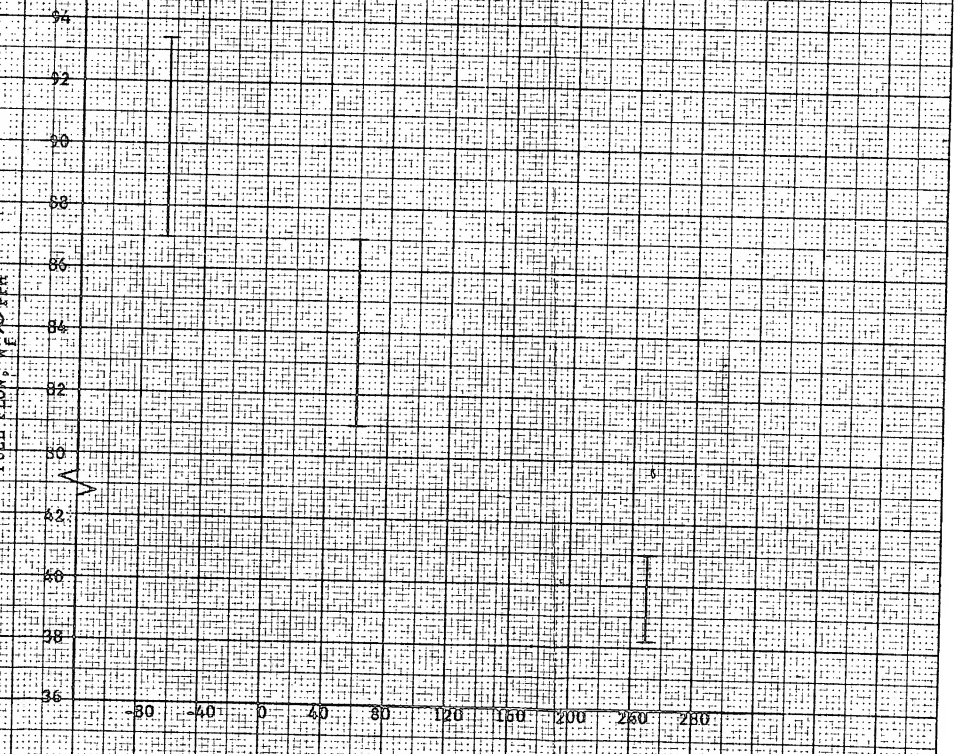
TEMPERATURE BIAS

ACCELERATION LIMIT SCHEDULE

SET THE FOLLOWING CONDITIONS: 75° PLA, 2940 ± 2 RPM N_{HP} AND VARY T_{L2} AND P_b AS LISTED IN THE TABLE BELOW.

RECORD: W_f AT EACH POINT

ITEM	T_{L2} °F	P_b PSIA	RECORD W_f ~ PPH	LIMITS W_f ~ PPH
1	250	20		3820-4100
2	59	50		8100-8695
3	-65	70		8705-9365
4	59	50		WITHIN ± 250 PPH OF ITEM 2



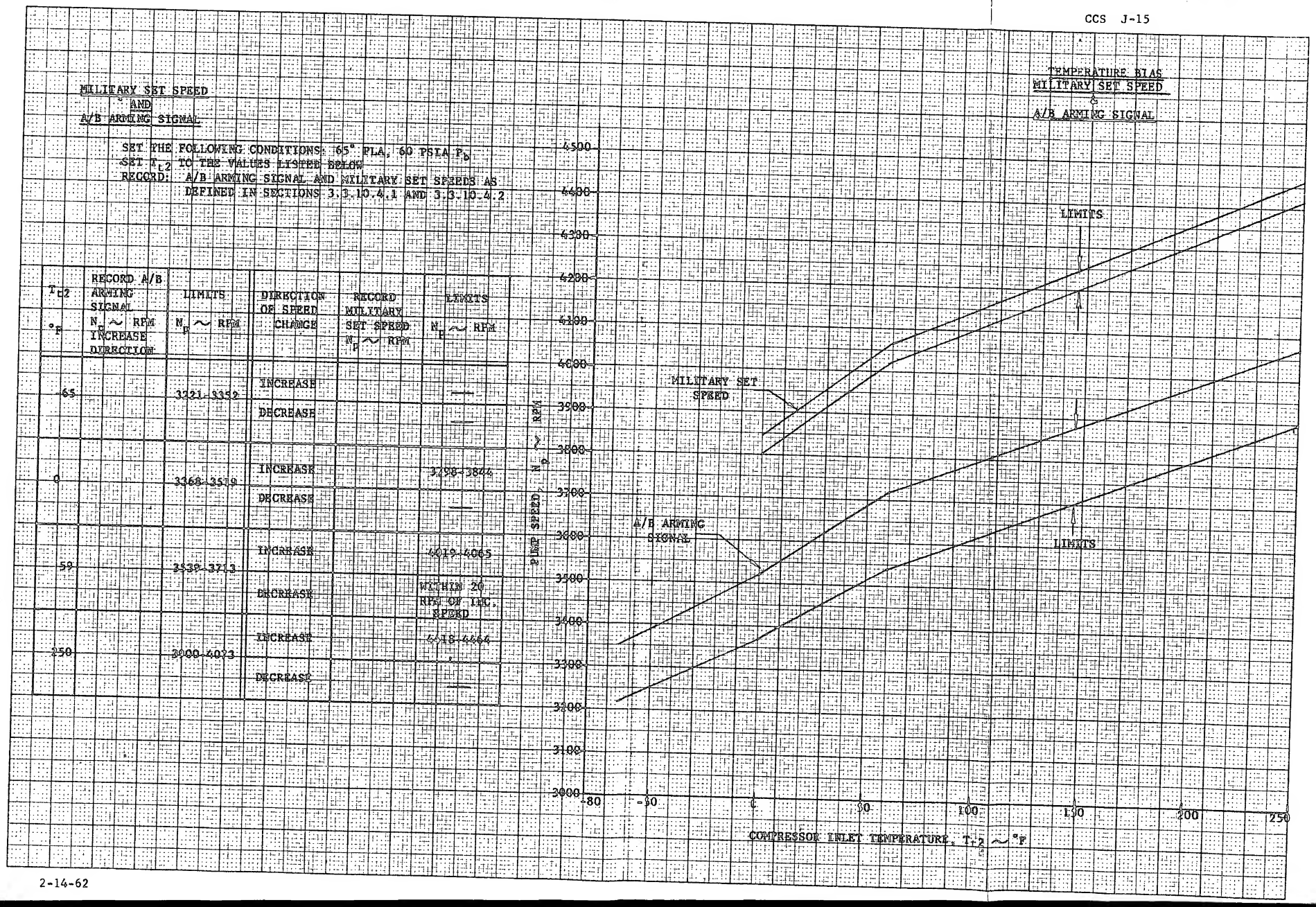
TEMPERATURE BIAS
ACCELERATION LIMIT
SCHEDULE

2-14-62

MILITARY SET SPEED AND A/B ARMING SIGNAL

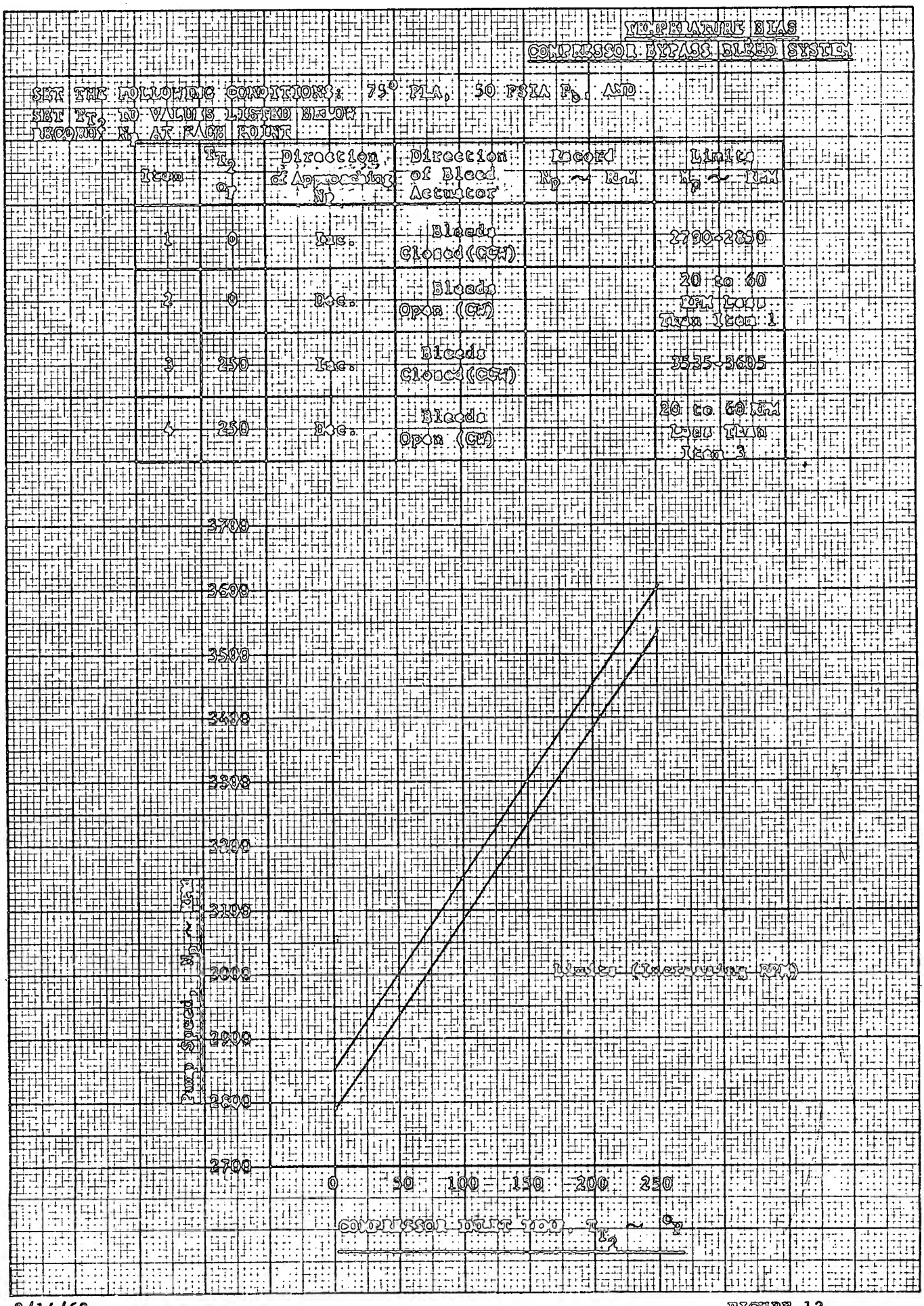
SET THE FOLLOWING CONDITIONS: 65° PLA, 60 PSIA P_b
SET T_{t2} TO THE VALUES LISTED BELOW
RECORD: A/B ARMING SIGNAL AND MILITARY SET SPEEDS AS DEFINED IN SECTIONS 3.3.10.4.1 AND 3.3.10.4.2

T_{t2} °F	RECORD A/B ARMING SIGNAL $N_p \sim$ RPM INCREASE DIRECTION	LIMITS $N_p \sim$ RPM	DIRECTION OF SPEED CHANGE	RECORD MILITARY SET SPEED $N_p \sim$ RPM	LIMITS $N_p \sim$ RPM
-65		3221-3352	INCREASE		—
			DECREASE		—
0		3368-3519	INCREASE		3798-3844
			DECREASE		—
59		3539-3713	INCREASE		4019-4065
			DECREASE		WITHIN 20 RPM OF REC. SPEED
250		3900-4073	INCREASE		4418-4464
			DECREASE		—



2-14-62

Approved For Release 2009/07/08 : CIA-RDP67B00657R000100190001-9



2/14/62

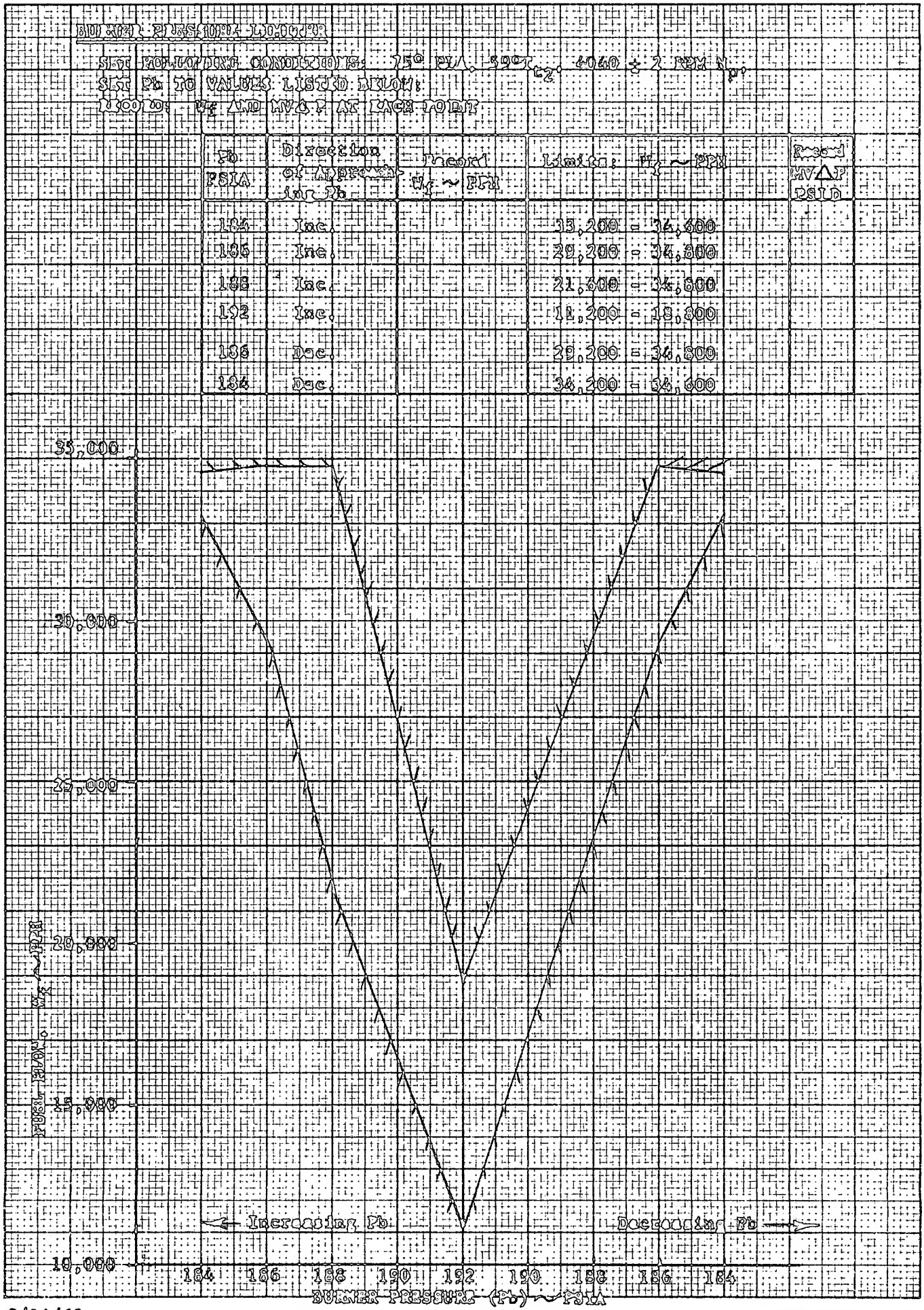
FIGURE 13

CCS J-15

BURNER PRESSURE LOOP "B"

SET FOLLOWING CONDITIONS: 15° F/A, 590° T_{t2}, 4040 ± 2 RPM N_1;
SET P_b TO VALUES LISTED BELOW;
RECORD W_f AND ΔP AT EACH POINT

P_b PSIA	Direction of Approach to P_b	Record W_f ~ PPH	Limits: W_f ~ PPH	Recd ΔP PSID
184	Inc.		33,200 ± 34,600	
186	Inc.		29,200 ± 34,800	
188	Inc.		21,600 ± 34,800	
192	Inc.		11,200 ± 18,800	
186	Dec.		29,200 ± 34,800	
184	Dec.		34,200 ± 34,600	

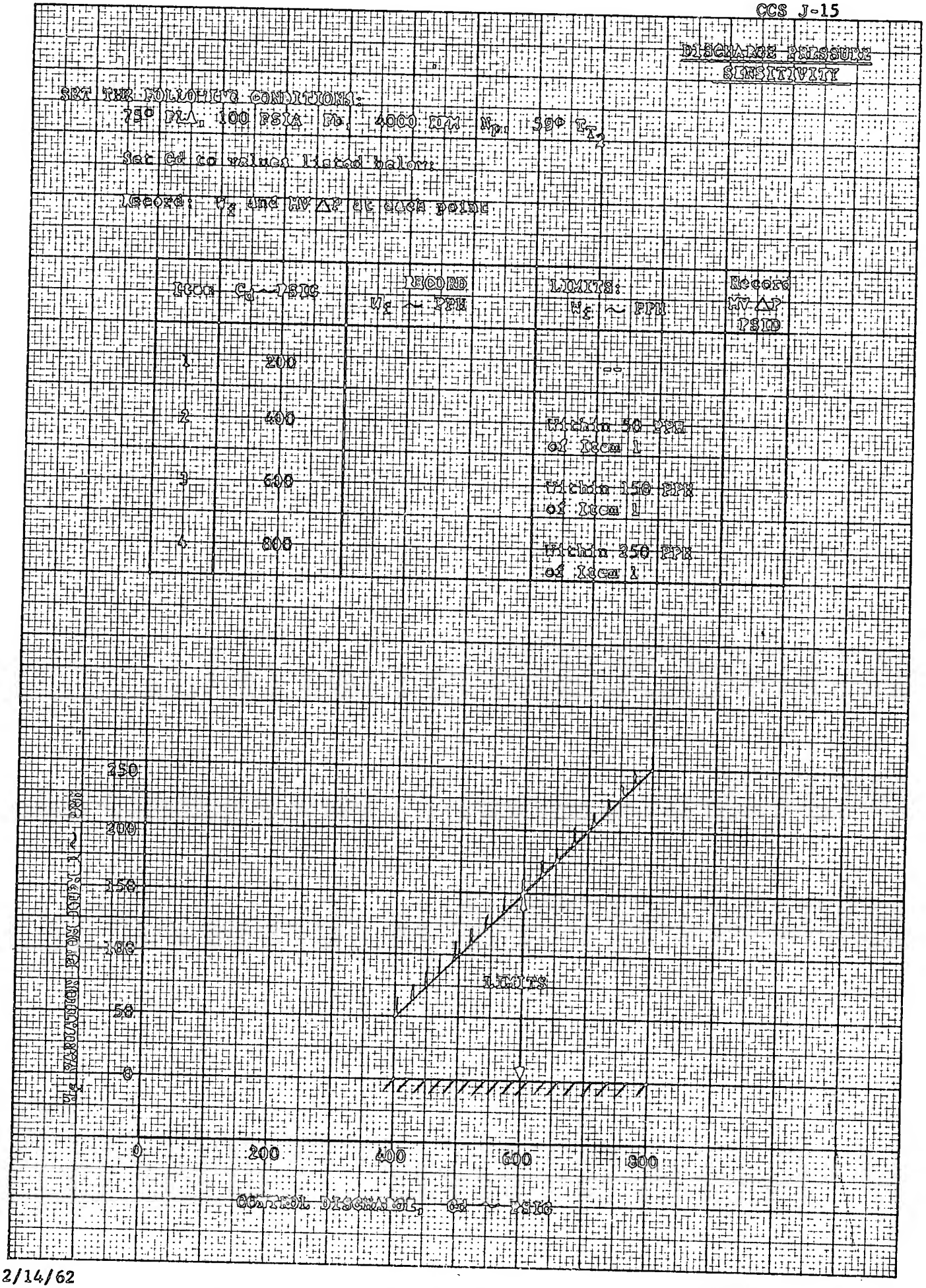


10 X 10 TO THE ½ INCH 359T-11
KEUFFEL & ESSER CO. MADE IN U.S.A.
ALBANENE ®

2/14/62

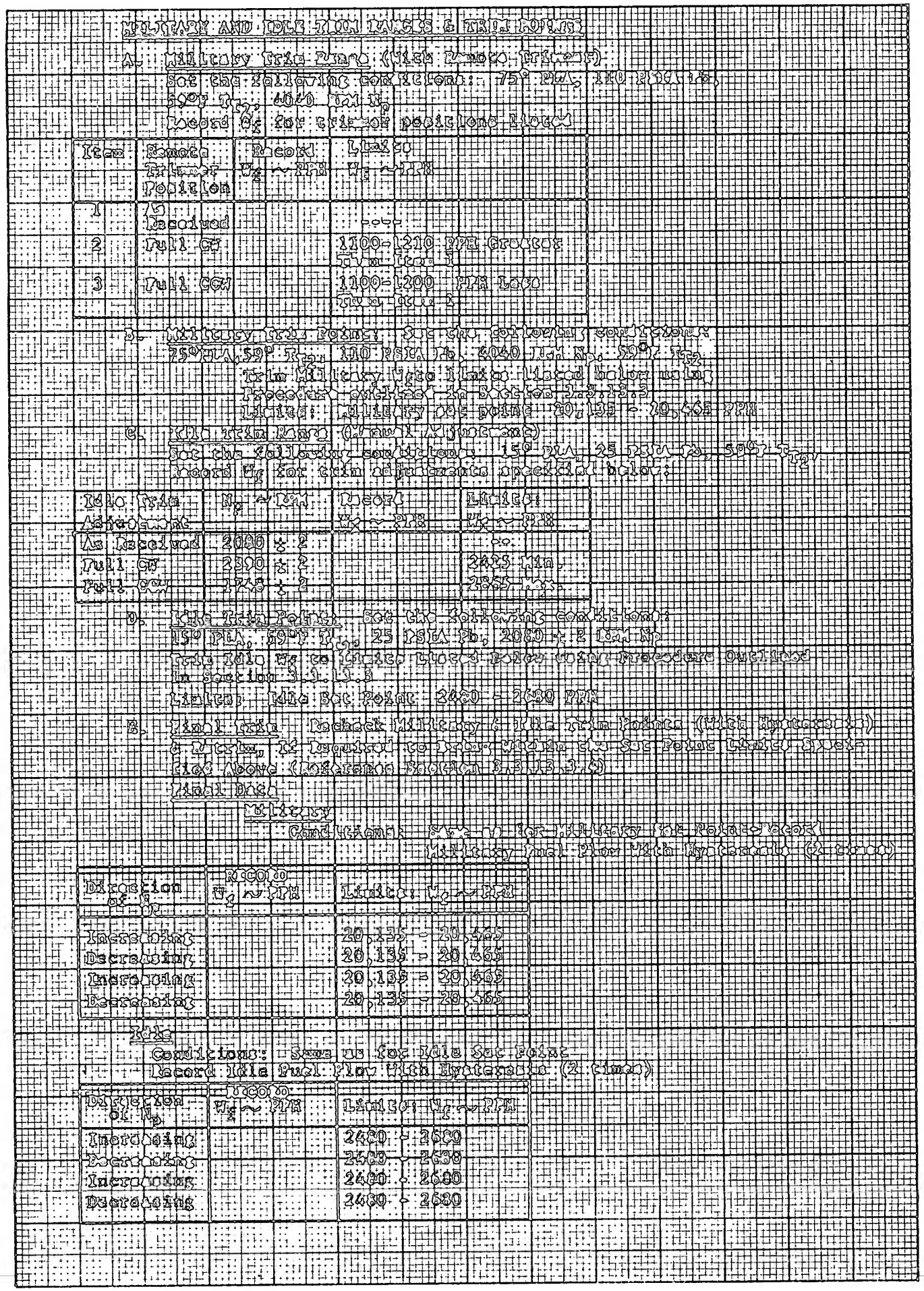
FIGURE 14

CCS J-15



2/14/62

FIGURE 15



2/14/62

FIGURE 16

This Schedule is Applicable For
Vendors When Referenced in PWA
Purchase Specification or Directed
By PWA Engineering

PRATT & WHITNEY AIRCRAFT
FLORIDA RESEARCH AND DEVELOPMENT CENTER

COMPONENT CALIBRATION SCHEDULE FOR EXHAUST NOZZLE CONTROL PWA P/N 2057426 (HSD P/N 576376) FOR J58 (JT11) ENGINES

1. Quantity to be Tested

All of the exhaust nozzle controls, PWA P/N 2057426 shall be bench tested at P&WA in accordance with this component calibration schedule.

2. General Requirements

2.1 Equipment Requirement

2.1.1 Flowbench capable of supplying at least 1000 pph at 4000 psig.

2.1.2 Heat Exchanger to maintain the fuel temperature at the control inlet within the range of 80° to 100°F.

2.1.3 Filter containing a 10 micron, or smaller, element and installed in the stand line to the exhaust nozzle control inlet as shown on Figure 1.

2.1.4 Hand Valves, one 3/8" needle valve installed in the transmission pressure line and three additional hand valves as shown on Figure 1.

2.1.5 Pressure Reducer Valve to maintain fuel pressure to the regulated inlet of the exhaust nozzle control at 1930 to 2070 psi above servo return pressure. The valve is to be a non bypass type.

2.1.6 Protractor to mount on control feedback shaft, at least 0 to 60 degrees range having markings in at least one (1) degree increments with an accuracy of ± 1/4 degrees within this range. There must be provisions for indexing the protractor according to 3.2.1.

2.1.7 Instrumentation for taking the measurements listed below:

a. P_S - Supply pressure, at least 1000 to 5000 psig pressure range with an accuracy of ± 25 psig within this range.

b. P_T - Transmission pressure, at least 1000 to 5000 psig pressure range with an accuracy of ± 25 psig within this range.

ISSUED: 4-26-61
REVISED: 3-8-62

c. P_R - Regulated pressure, at least 1000 to 5000 psig pressure range with an accuracy of ± 25 psig within this range.

d. P_{BR} - Body return pressure, at least 25 to 400 psig pressure range with an accuracy of ± 3 psig within this range.

e. P_{MR} - Main return pressure, at least 25 to 400 psig pressure range with an accuracy of ± 3 psig within this range.

f. W_F - Return fuel flow, at least 300 to 2000 pph flow range with an accuracy of ± 1% of indicated reading within this range.

2.2 Test Fluid

Test fluid shall be PMC 9041 or PMC 9073.

2.3 Depreservation

If the control has been preserved with flushing oil, it must be depreserved in accordance with Engineering Instruction No. 125.

2.4 Installation

2.4.1 The control shall be mounted on the flow bench as shown on Figure 1.

2.4.2 Test schematic diagram is shown on Figure 1.

2.5 Data Required

2.5.1 The following data shall be recorded on each data sheet:

Control Serial Number
PWA Part Number
HSD Stock List Number
Test Fluid Type

2.5.2 The following data shall be recorded when specified:

P_S - Supply Pressure
P_T - Transmission Pressure
P_{BR} - Body Return Pressure
P_{MR} - Main Return Pressure
W_F - Return Fuel Flow
Leakage

3. Test Requirements

3.1 General Test Conditions

3.1.1 The test fluid temperature at the control inlet shall be maintained within the range of 80° to 100°F.

3.1.2 The control feedback shaft angle shall be maintained at 5° for all test conditions.

3.2 Test Procedure

3.2.1 Protractor Index - Install the protractor on the control feedback shaft and index the protractor to read 30 degrees when the feedback shaft is positioned as shown in Figure 1. (A radial line from the feedback shaft centerline passes through the missing spline tooth center and the indexing hole center.)

3.2.2 Overboard Drain Leakage - With valve V-4 maintained in the closed position, adjust valves V-1, V-2, and V-3 to set and maintain the following test point over a five (5) minute period. Record P_S, P_{BR}, P_{MR}, P_T, W_F, and any overboard drain leakage.

Test Point	P_S PSIG	P_R-P_{BR} PSI	P_T PSIG	P_{BR} PSIG	P_{MR} PSIG
1	2900 to 3100	1930 to 2070	1400 to 1600	45 to 50	170 to 180

Limits: Overboard drain leakage must not exceed 5 drops per minute over the five (5) minute period. Return fuel flow (W_F) shall not exceed 1600 pph.

3.2.3 External Leakage - Adjust valves V-1, V-2, V-3, and V-4 to set and maintain the following test point over a five (5) minute period. Record P_S, P_{BR}, P_{MR}, P_T, and any external leakage.

Test Point	P_S PSIG	P_T AND P_R PSIG	P_{BR} AND P_{MR} PSIG
2	3400 to 3600	2000 to 2200	190 to 210

Limits: There shall be no external leakage from any protion of the control other than from the overboard drain.

4. Preservation and Storage

After completion of testing, the control shall be prepared for storage in accordance with Engineering Instruction No. 125. Protective covers and containers shall be used to prevent damage or contamination of the control.

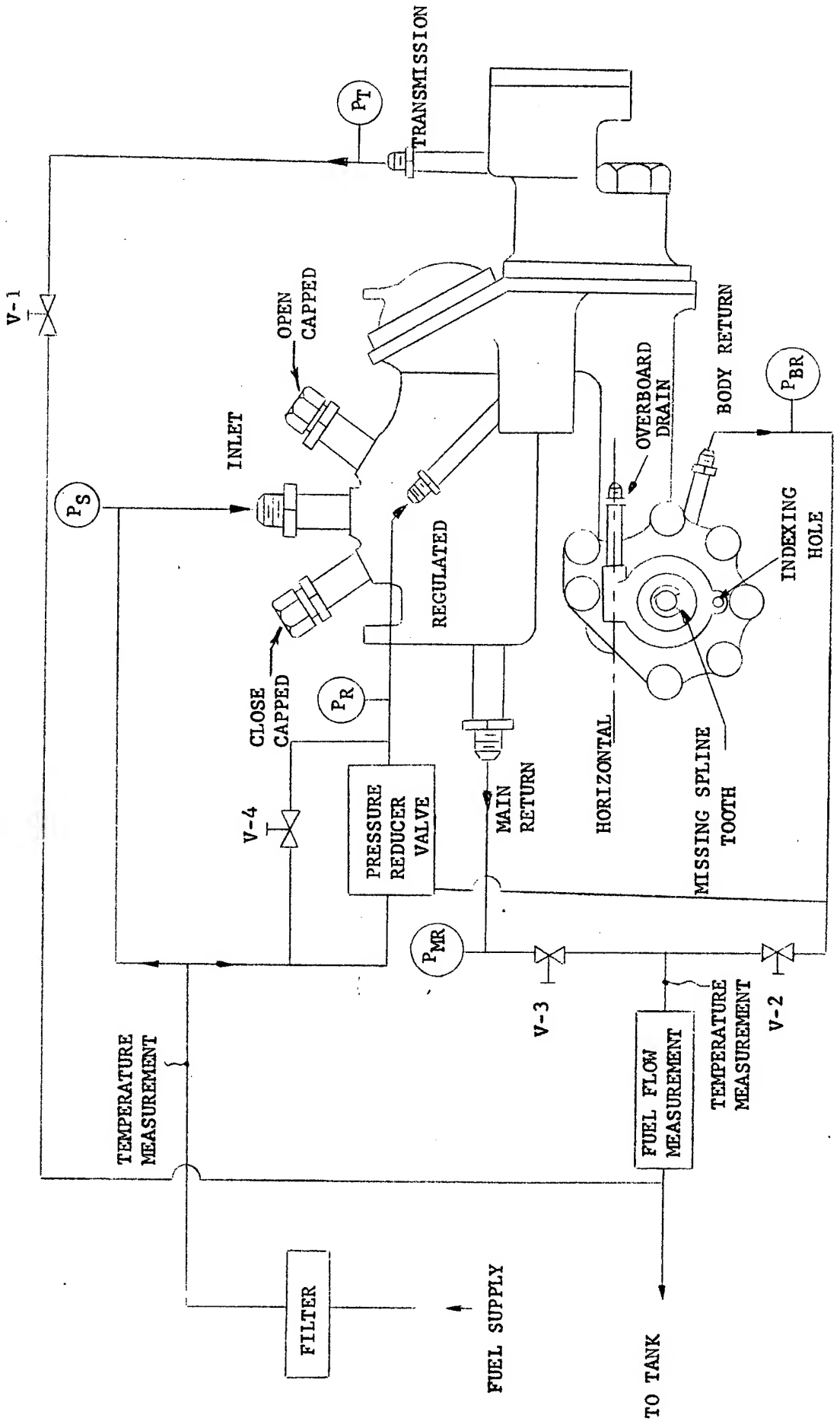
5. Applicable Figures

Figure 1 - Test position and schematic diagram 3-8-62.

ISSUED: 4-26-61
REVISED: 3-8-62

Approved:

STAT



EXHAUST NOZZLE CONTROL

TEST POSITION AND SCHEMATIC DIAGRAM

FIGURE I

HSF-755D 4/61

HS 1584

CODE IDENT. NO. 73030

PAGE 1 OF 6

HAMILTON STANDARD
DIVISION OF UNITED AIRCRAFT CORPORATION
WINDSOR LOCKS, CONNECTICUT, U. S. A.

SPECIFICATION NUMBER 1584

TITLE ENGINE CONTROL JFC-47
FLIGHT SUITABILITY BENCH TEST OF

PREPARED BY [redacted] 4-25-62 DATE
APPROVED BY [redacted] 5/6/62 DATE
APPROVED BY _____ DESIGN _____ DATE
APPROVED BY _____ INSPECTION DEPT. _____ DATE
APPROVED BY _____ MATERIALS ENGR. _____ DATE
GOVERNMENT (WHEN REQ'D) _____ _____ DATE

APPROVED BY [redacted] 6-7-62 DATE
APPROVED BY _____ _____ DATE
EXP. RELEASE _____ _____ DATE
APPROVED BY _____ PRODUCTION DEPT. _____ DATE
PROD RELEASE _____ _____ DATE

STAT
STAT

1. SCOPE

1.1 This specification defines a Flight Suitability Bench Test for the JFC47 main control and components. The control will be subjected to a minimum of 50 hrs. of cyclic endurance and 32 hrs. of additional cycling on the Windmill Check & Dump Valve in accordance with Curves 1,2 & 3. After endurance testing, the requirements in paragraph 3.4.1 must be met.

1.2 The flight conditions and engine parameters to be simulated are as follows:

Symbol		Units
Tamb	Ambient temperature	°F
Tf	Fuel temperature	°F
Nc	Control speed	rpm
PLA	Power Lever angle	degrees
Pb	Compressor discharge pressure	psia
Tt2	Compressor inlet temperature	°F
Pt2	Compressor inlet pressure	psia
TRIM	Remote trimmer	- -

2.0 Description of Control

Components to be tested are defined as the JFC47 control and components with a modified Tt2 bellows to allow for pneumatic cycling. Since the temperature system will be pneumatically cycled, the Tt2 sensor will not be in the system. To qualify the sensor, its output will be mechanically loaded and the sensor will be placed in the ambient box during the test.

2.1 Control components

ABR	PART NAME	P/N
JFC47	Main Control	576499
ENC	Exhaust Nozzle Control	576376
C&DV	Check & Dump Valve	576497
PRV	Pressure Regulator	576477
TRIM	Remote Trimmer	576495
PDC	ENC Pressure Drop Controller	580710

2.2 Quality Control

2.2.1 Assembly

The control will represent the "Y" configuration as nearly as possible without jeopardizing the completion of the program by June 1962. In the event "Y" hardware is not available, replacement hardware will be of the "E" or "X" configurations, whichever is more readily available and applicable. Assembly and calibration of the control will be under the same quality requirements as saleable controls with the exception that final decisions will be made by the responsible engineer.

2.2.1.1 Parts List

All parts will be recorded on the parts list by part number, change letter and signed in by inspection. The use of questionable hardware will be at the discretion of the responsible engineer. Questionable hardware must, in the responsible engineer's opinion, be functionally acceptable.

2.2.1.2 Historical Log

The historical log will maintain as applicable, an accurate record of component performance. Each disassembly of control, rework or replacement of any part and assembly of control shall be recorded in this historical log. The Inspection Department will be responsible for the validity of each entry.

Mounting, dismounting and reason for dismounting the control at the rig will be recorded by test personnel in the historical log and on log sheets. Every entry should be brought to the attention of the responsible engineer.

3.0 Description of Test

The test will be conducted in the high temperature ambient box on Rig J-7 in the Hot Fuel Laboratory.

These Components will be installed for the test: Main Control, ENC, ENC Pressure Regulator, ENC Pressure Drop Controller, Remote Trimmer, and W/M Check & Dump Valve. In so far as practical, the components will be installed in the test rig as they would be on an engine. Total fuel flow to the control will not be an automatically cycled procedure, but will be set to simulate the main engine fuel pump output at each of the control speeds shown in Figure 1. Total fuel flow will be set to equal 10 times control rpm.

Figures 1 & 2 define a cycling schedule for 8 control parameters which will be varied for the test. The parameters will be varied and all the JFC-47 control components except the Exhaust Nozzle Control will function like they would during anormal mission.

Since complete speed reset simulation, due to Exhaust Nozzle Control modulation is not practical, an open-close signal will be sent to the Exhaust Nozzle Simulator (actuator & load table).

Upon completion of 50 hours of cycling at 445°F fuel temperature the W/M Check & Dump Valve will be separately cycled as shown by Figure 3. The fuel temperature during this test will be 550°F. The intent of this test is to simulate the higher fuel temperature which this component sees under flight conditions, due to the cooling load imposed on metered fuel flow between the main control and the W/M Check & Dump Valve.

An example of a specific component exercise can be seen in Figure 1 which at time 5 minutes the CDP Limiter is operative. Another example can be seen at time 57 minutes which is a power lever off signal. This results in W/M bypass and shut-off valve going through a normal sequencing operation.

Since control of fuel and ambient temperatures cannot be adequately simulated, they bear no relationship to the other six imputs. A change in scale should be noted on the fuel and ambient temperature schedules.

The cycling is defined in a manner that periodic readings of control output will be able to be obtained without stopping the cycling equipment.

3.1 Pre-endurance inspection

Prior to assembly, measurements and observations shall be noted on known parts subject to wear or have had post performance problems.

3.2 Calibration to H.S. Specifications

System components shall be calibrated to the following specifications:

Components	Spec
Main Control	HS 1234
Exhaust Nozzle Control	HS 1508
Pressure Regulator	HS 1494
Check & Dump Valve	HS 1506
Remote trimmer	HS 1350
ENC Pressure Drop Cont.	HS 2050

Deviations from the calibration specifications shall be at the discretion of the responsible engineer.

3.2.2 Final data

Upon completion of calibration, final data will be run three (3) times to determine control repeatability. This data shall be presented to Pratt & Whitney for review prior to endurance testing.

3.3 Endurance Test

3.3.1 The test shall consist of repeated runs of the mission cycle controls ambient conditions and control imput signals. Data will be taken two (2) times during a two (2) hr. mission cycle. The following data is to be recorded on log sheets:

Symbol		Units
Nc	Control Speed	rpm
Wf	Metered flow	pph
Wft	Total flow	pph
Wfr	Recirculation flow	pph
Pin	Main Control supply pressure	psig
Pf1	Control body pressure	psig
Pf3	Control discharge pressure	psig
ΔP	Throttle Valve ΔP	psig
Pb	Burner Pressure	psia
Pt2	Compressor inlet pressure	psia
Tt2	Compressor inlet Temp.	°F

Symbol		Units
Tf	Fuel Temperature	°F
Tamb	Ambient Temperature	°F
PLA	Power Lever Angle	degrees
A/B	After Burner Signal	psi
Prec	Recirculation Valve Signal	psi
Psh	Shut-off valve signal	psi
Ps	High Pressure Supply (ENC)	psi
Pr	Regulated Pressure (ENC PRV)	psi
Ptr	Transmission Pressure	psi
Pm1	Modulated Pressure 1 (actuator pressure)	psi
Pm2	Modulated Pressure 2 (actuator pressure)	psi

3.3.2 Test Fluid

The test fluid will be P&W 523B. Contamination will not be used in the fuel. The test fluid will be replaced after 16 hours, 32 hours and 50 hours and after 16 hours of W/M Check & Dump Valve cycling is completed.

3.3.3 Rig

Rig filters will be examined prior to and subsequent to testing. Replacing the filters at any time during the test will be at the discretion of the responsible engineer. A record of any work done in the filters such as cleaning or replacing should be maintained and the condition of the filter at the time it is removed from the rig should also be recorded.

3.3.3.2 Control Filters

Examination and cleaning of the control filters at any time during the test will be at the discretion of the responsible engineer. A record must be kept of filter examinations and the condition of the filter at the time it is removed from the control.

3.3.4 Mission Cycle

The mission cycle is defined in Curves 1, 2, & 3. Imput signals in Curve 1 will be controlled by a cycling rig and superimposed on the manually controlled fuel and ambient temperatures in Curve 2. Curve 3 defines the W/M Check & Dump Valve cycling. The frequency of temperature cycling will be dictated by test facility limitations.

3.4 Post Endurance Calibration Check

Final calibration data will be rerun three (3) times for comparison with original data. Calibration shifts shall not exceed requirements defined in Paragraph 3.4.1.

3.4.1 Service Limits

The three runs of final calibration data must be repeatable within the repeatable limits set up in the following tabulation:

SERVICE LIMITS

Acceleration & Topping Schedule	Repeatable Limits	Average Limit
Starting	±2% Wf	±2% Wf
Acceleration	±2% Wf	±2% Wf
Military Droop	±2% Wf	±2% Wf
Topping	±1½% Nc	±1½% Nc
Tt2 Reset Schedule	±2% Wf	±2% Wf
Military Droop	±2% Wf	±2% Wf
Idle Droop	±1½% Nc	±1½% Nc
Military Droop Bias	±2% Wf	±2% Wf
Idle Droop Bias	±1½% Nc	±1½% Nc
CBA	±1½% Nc	±1½% Nc
Tt2 Fail Safe	±2% Wf	±2% Wf
Integrating System Temp. Bias	±1½% Nc	±1½% Nc

The average of the three Pre-Endurance Final Data runs (Para 3.2.2) shall be calculated to defined the control calibration prior to the start of the endurance test. Data points from these three tests must not deviate from this average calibration by more than the limits specified as Repeatable Limits.

The average of the three Post-Endurance, Final Data runs (Para. 3.4) shall be calculated to define the control calibrations after the endurance testing is completed. Data points from these three tests must not deviate from this average calibration by more than the limits specified as Repeatable Limits.

In addition, the Post Endurance Calibration average must agree with the Pre-Endurance calibration average within the limitd specified as Average Limits.

3.5 Post Endurance Inspection

After completion and preliminary evaluation of the post endurance data, the control shall be completely disassembled for examination of all components. Measurements as necessary will be made to disclose excessively worn, distorted or weakened parts. Photographs of significant parts will be taken.

4.0 Final Report

The final report shall be a Hamilton Standard Engineering Report. The report will contain a description of the control, the test and any abnormalities that were noticed during the test. Photographs of test facilities and significant control parts, reports an part failures from the Material Department, pertinent curves and log sheets will be indicated in the report.

HS F-927 6/56

TEST NO. JFC-47.1.15 HAMILTON STANDARD PAGE 1 OF _____

PLAN OF TEST

STAT

UNCODED

JOB: Flight Suitability Test (50 hr. Q.T.) PLAN PREPARED

PROJECT & ORDER: APPROVED BY:

INSTRUCTION: TEST ENGINEER:

TIME PERIOD: May 15, 1962 TO June 1, 1962

1. WHAT IS ITEM BEING TESTED?

2. WHY IS TEST BEING RUN? WHAT WILL RESULTS SHOW OR BE USED FOR?

3. DESCRIBE TEST SET UP INCLUDING INSTRUMENTATION. ATTACH SKETCH OF INSTALLATION.

4. ITEMIZE RUNS TO BE MADE GIVING LENGTH OF EACH AND READINGS TO BE TAKEN.

5. SPECIAL INSTRUCTIONS: SAFETY PRECAUTIONS FOR OPERATORS AND HANDLING EQUIPMENT. OBSERVATIONS BY SIGHT, FEEL, OR HEARING. LIST POINTS OF OBSERVATION WHICH MIGHT CONTRIBUTE TO ANALYSIS OF (A) PERFORMANCE OF UNITS, (B) INCIPIENT TROUBLE BEFORE IT OCCURS, AND (C) CAUSE OF FAILURE.

6. HOW WILL DATA BE USED OR FINALLY PRESENTED? GIVE SAMPLE PLOT, CURVE, OR TABULATION AS IT WILL BE FINALLY PRESENTED.

NUMBER ENTRY AS LISTED ABOVE AND DESCRIBE BELOW

1. JFC-47 Control Components consisting of Main Control, Remote Trimmer, Exhaust Nozzle Control, Exhaust Nozzle Control Pressure Regulating Valve and Windmill Bypass Check and Dump Control.

The components being tested are defined in detail as follows:

Main Control	*P/L 576499	P/N 576499	HS Spec 1234
Exhaust Nozzle Control	P/L 576376	P/N 576376	HS Spec 1508
ENC Press. Reg. Valve	P/L 576477	P/N 576477	HS Spec 1494
ENC Press. Drop Cont.	P/L 580710	P/N 580710	HS Spec [illegible]20[illegible]
Windmill Bypass Valve	P/L 576497	P/N 576497	HS Spec 1350
Remote Trimmer		P/N 576495	HS Spec 1350

* See VEM JFC-47.1.5348 for specific differences from a standard "Y" type Control.

2. To satisfy contractual requirements of work statement (fiscal 1962) and to certify 50-Hour Flight Performance Suitability.

3. See attached schematic 20X-30441, HS Spec 1548 and cycling curves F-5337, F-5338 and F-5339. The test will be run in J-7 rig which is a high flow-high temperature rig containing an over which will allow all the components listed in 1. to be tested at high ambient. An actuator and load table simulating the engine exhaust nozzle will be installed outside of the oven. The actuator will be under control of the Exhaust Nozzle Control during cycling tests.

INDEX TO PLAN OF TEST

1. What is Item Being Tested?

2. Why is Test Being Run? What Will Results Show Or Be Used For?

3. Describe Test Set Up Including Instrumentation. Attach Sketch of Installation.

4. Itemize Runs to Be Made Giving Length of Each and Readings to be Taken.

I Pre 50-Hour Component Qualification Data (H.S. 1234C)
- Run 1
- Run 2
- Run 3

II Pre 50-Hour Component Qualification Circling Data
- Cycle 1
- Cycle 2
- Cycle 3

III 50-Hour Component Qualification Test
- Phase A
- Phase B
- Phase C

IV High Temperature Reference Data

V Post 50-Hour Component Qualification Cycling Data
- Cycle 1
- Cycle 2
- Cycle 3

VI Post 50-Hour Component Qualification Data (H.S. 1234C)
- Run 1
- Run 2
- Run 3

VII Windmill Bypass Check & Dump Valve High Temperature Qualification Test.

5. Special Instructions: Safety precautions for operators and handling equipment. Observations by sight, feel, or hearing. List points of observation which might contribute to analysis of (a) Performance of Units (b) Incipient trouble before it occurs, and (c) Cause of failure.

6. How will data be used or finally presented? Give sample plot, curve, or tabulation as it will be finally presented.

5-31-60

"Data Plotting Responsibility"

Data	[illegible]
[illegible] Points	III & V
Rating Lines	D & E
[illegible] Proof Tapping	L
Testing	M
The [illegible]	N
with Speed	V

STAT

The above people are responsible for plotting their assigned data on the flight instability. Progressive plots of data are to be available no more than 48 hours after the time the data was actually given.

STAT

A standard temperature sensor will not be employed. Rather a pneumatic system using the control diaphragms will be utilized. The temperature sensor, P/N 574154 will be pre-calibrated and placed in the oven and will be post calibrated upon completion of the Test. See Curve A for test pressures and for a cross plot of Temperature Tt2P vs. simulated pressure at the diaphragm cross plotted against temperature servo position. This curve will be referenced for all Tt2 values and called Tt2P.

Upon completion of 50 hours of cycling per F-5337 and F-5338, the Windmill Bypass Check & Dump Valve will be separately cycled as shown by F-5339. The intent of this test is to simulate the higher fuel temperature which this component has under flight conditions, due to the cooling load imposed on metered flow between the main control and the Windmill Bypass Check & Dump Valve.

Instrumentation shall be provided to monitor the following:

Nc	Control Speed	rpm	P	Throttle Valve	psi
Pf2	Control Inlet Press.	psi	Wfm	Transmission Line Flow	pph
Pf3	Control Disch. Press.	psi	Wft	Total Flow to Control	pph
Pf1	Control Body Press.	psi	Wfc	W/M BP Cooling Flow	pph
Pb	Burner Press.	psia	Wf	Metered Flow	pph
CIP	Compressor Inlet Press.	psia	Tf1	Main Cont. Inlet Temp.	°F
Tt2P	Comp. Inlet Temp. Sim.	psi	Tf2	W/M BP Inlet Fuel Temp.	°F
Tamb	Oven Temp	°F	Tf3	ENC Inlet Fuel Temp.	°F
CBA	Comp. Bleed P.V. Act.	Closed or Open	PLA	Power Lever Angle	-
EN	Exhaust Nozzle	Closed or Open			

4. The test will be run with a Control which is calibrated to HS 1234C. Curve deviations from the limits of HS 1234C will result since the limits in HS 1234C were determined from Ng 3-0 Cam P/N and we are using an Ng 3-d Cam P/N . The intent of the test is to determine if problems result from this test rather than the ability to meet the specification se. Instrumentation accuracies shall be defined by HS1234C.

The control of Back Pressure shall be in accordance with Pg 46 of HS 1234C and Total Wf shall be in accordance with Pg 50 of HS 1234C, for all tests. (See cycling schedule for approximate Back Pressure (Pf3) and Total Wf (Twf). These values may be used when cycling.

The calibrations of the Exhaust Nozzle Control, Exhaust Nozzle Control Pressure Regulating Valve, ENC Press. Drop Cont., Windmill Bypass Valve Package and "In-Flight" Trimmer shall be run to the applicable HS specifications without exception.

For record purposes, the following procedure shall be adhered to. The sequence of tests may be altered as necessary.

I Pre 50 Hour Component Qualification Date (HS 1234C)
Run 1 100°F Fuel - Room Temp. Ambient

1A. Speed Servo Calibration - Paragraph 6.2.7
1B. CIP Servo Calibration - Paragraph 7.4.2
1C. Temperature Servo Calibration - Paragraph 8.4.5
1D. Max Line Data - at Pb values = 15*, 20*, 25*, 30*, 35, 40*, 50, 60*, 70, 80*, 90, 100*, 110, 120*, 130, 140*, 150, 160*, 170, 180*, 190 & 200* with hysteresis at 180, 160, 140*, 120, 100, 80*, 60, 40 and 20 psia. (Ref.

Paragraph 22.3.2)

1E Min Line Data - at Pb values = 20, 25, 30*, 35, 40*, 45, 50, 60*, 80, 100*, 120, 140*, 160, 180* & 200. Hysteresis at 140, 100*, 60 & 20. (Ref. Para. 22.3.1).

1F Power Lever Torque Test - Paragraph 15.0

1G Exhaust Nozzle Proportional System - Paragraphs 16.4.1, 16.4.3 & 16.4.5.

1H Proportional System Deadband - Paragraph 16.6.2 & 16.6.4.

1I Military Speed Adj. of Integ. Syst. and A/B Signal - Paragraph 17.5 and 17.6.

1J. Power Lever Angle Check - Paragraph 22.2.0

1K Minimum Flow Stop - Paragraph 22.4

1L Starting Accel. Limiting & Topping - Paragraph 22.5.

1M Starting Schedule - Paragraph 22.5.3.

1N Compressor Inlet Temp. Schedule at equivalent Tt2 values of -65°F, *0°F, 59 F* 140 F, *200 F, 250 F and 300 F, *400 F, 500 F, *600 F, 700 F and 800 F*. Hysteresis at 600 F, 400 F, 200 F, 59 F and -65 F. - Paragraph 22.55.5.

1O Body Pressure, Bypass Flow & Discharge Pressure Sensitivity - Paragraph 22.5.7.

1P Power Lever Flat and Squencing Test - Paragraph 22.6.0

1Q Military & Idle Droop Lines - Paragraph 22.7.1.

1R Military & Idle Droop Bias - Paragraph 22.7.2

1S Compressor Bleed Actuator - Paragraph 22.9.

1T CBA Pilot Valve Actuator Stall Torque - Paragraph 22.9.4.

1U CDP Limiter - Paragraph 22.10.0

1V Military Speed - Set per tabulation and record metered Wf. Record also the Nc and Wf at Nc which the ENC load table goes from open to close.

Tt2	Tt2P	CIP	N	Pb	CBA-Open or Close	Wf	Integ* - Nc to Close Nozzle	Wf@Int. Nc Wf@ Close Nozz
59°	( )	14.7	3850*	111				
120	( )	21.7	4124	158				
120	( )	13	4124*	94.7				
300	( )	15	4192	83				
300	( )	15	4192*	71.4				
415	( )	21.7	4147	90.4				
800	( )	39.5	4093	97.5				
800	( )	12	4093*	27.5				
800	( )	6.8	4093	16.3				
415	( )	3.5	4147*	14.2				
300	( )	3.1	4192	16.8				
300	( )	3.1	4192*	14.5				
120	( )	2.4	4124	17.2				
10	( )	2.3	3669*	16.8				

1W Proof Pressure Test - Paragraph 4.1

Run 2

2A as in IA
2B as in IB
2C as in IC
2D as in ID except run only asterisked points.
2E as in IE except run only asterisked points.
2H as in IH
2L as in IL - test 1000, 1500, 2000, 2500, 3000 and 3500 Nc only
2M as in IM - test 1000, 1200 & 1400 Nc only.
2N as in IN except run only asterisked points
2Q as in IQ
2R as in IR
2S as in IS
2U as in IU
2V as in IV except run only asterisked points.

Run 3

3A as in IA
3B as in IB
3C as in IC
3D as in ID except run only asterisked points
3E as in IE except run only asterisked points
3H as in IH
3L as in IL test 1000, 1500, 2000, 2500, 3000 & 3500 Nc only
3M as in IM test 100, 1200 & 1400 Nc only
3N as in IN except run only asterisked points
3Q as in IQ
3R as in IR
3S as in IS
3U as in IU
3V as in IV except run only asterisked points.

II Pre 50-Hour Component Qualification Cycling Data (Cycling Data)

Refer to F-5337 and F-5338 for this portion of the test. Set and manipulate the various control parameters in accordance with this schedule. Note on logsheets the function varied and the time it was varied. Cycling will start from zero hours starting and Cycle 1 and ending at the completion of Cycle 3.

Note Total Wf on F-5330 and use started valves when running at either of the four speeds called out. Note Pin at each of the values of Pb noted on F- and use these values for settings. Room temperature ambient and 100° fuel will be maintained.

On all record points, indicate portion of test and cycle number. i.e. II Cycle 3. For recording purposes Log: Pin, P, Pdrain, Tt2P, Nc, PLA, Pb, Temb, T fuel, Pt2, CBA (open or closed), Actuator (open or closed) specific gravity setting of flow meter and metered Wf. All setting are to be approached from the indicated direction defined by cycling schedule.

Cycle 1 Record Rints	1,2,3,4,5,6,7,8,9,10,11,12,13,14 & 15
Cycle 2 Record Points	1,2,3,4,5,6,7,8,9,10,11,12,13,14 & 15
Cycle 3 Record Points	1,2,3,4,5,6,7,8,9,10,11,12,13,14 & 15

III 50 Hour Component Qualification Test

Refer to F-5337 and F-5338 for this phase of the test. Set and manipulate the various control parameters in accordance with this schedule. Note on log sheets the function varied and the time it was varied. The procedure should be to have the radiant panel "ON" at all times that the Tamb = 800 F. Cycling will start from 0 hours - Starting at Phase A. Note Total Wf on F-5339 and use stated values when running at either of the four speeds called out. Note Pin at each of the values of Pb noted on F- and use these values for settings.

On all record points indication portion of test, cycle number and elapsed time from 0 hours considering only operating time. For recording purposes Log: Pin, P, P drain, Tt2P (psig), Nc, PLA, Pb, Tamb, Fuel Temp, Pt2, CBA (open or closed), Actuator (open or closed) specific gravity setting of flowmeter and metered Wf.

The total Qual Simulation involves Phase A (16 hours) which consists of 8 cycles of 2 hours each. Phase B (16 hours) which consists of 8 cycles of 2 hours each and Phase C (18 hours) which consists of 9 cycles of two hours each. All settings are to be approached from the indicated direction defined by cycling schedule. It shall be the responsibility of the attending engineer to maintain the attached summary data sheet.

Phase A	Cycle 1	Record	points	1,3,5,7,9,11,13 & 15
	2	"	"	2,4,6,8,10,12 & 14
	3	"	"	1,3,5,7,9,11,13 & 15
	4	"	"	2,4,6,8,10,12 & 14
	5	"	"	1,3,5,7,9,11,13 & 15
	6	"	"	2,4,6,8,10,12 & 14
	7	"	"	1,3,5,7,9,11,13 & 15
	8	"	"	2,4,6,8,10,12,& 14
Phase B	1	"	"	1,3,5,7,9,11,13, & 15
	2	"	"	2,4,6,8,10,12 & 14
	3	"	"	1,3,5,7,9,11,13, & 15
	4	"	"	2,4,6,8,10,12 & 14
	5	"	"	1,3,5,7,9,11,13 & 15
	6	"	"	2,4,6,8,10,12 & 14
	7	"	"	1,3,5,7,9,11,13, & 15
	8	"	"	2,4,6,8,10,12 & 14
Phase Phase C	1	"	"	1,3,5,7,9,11,13,15
	2	"	"	2,4,6,8,10,12 & 14
	3	"	"	1,3,5,7,9,11,13 & 15
	4	"	"	2,4,6,8,10,12, & 14
	5	"	"	1,3,5,7,9,11,13 & 15
	6	"	"	2,4,6,8,10,12 & 14
	7	"	"	1,3,5,7,9,11,13 & 15
	8	"	"	2,4,6,8,10,12 & 14
	9	"	"	1,3,5,7,9,11,13 & 15

IV High Temperature Reference Data

Upon completion of the 50-Hour Component Qualification Test and while maintaining 450 F fuel and 800 F ambient, run the following data points:

Run 1 Same as 1D
Run 2 Same as 1E
Run 3 Same as 1N
Run 4 Same as 1V

V Post 50-Hour Component Qualification Cycling Data.

Following the same procedure as in 4.II and record data at the following points:

Cycle 1 Record Points 1,2,3,4,5,6,7,8,9,10,11,12,13,14 & 15
Cycle 2 Record Points 1,2,3,4,5,6,7,8,9,10,11,12,13,14 & 15
Cycle 3 Record Points 1,2,3,4,5,6,7,8,9,10,11,12,13,14 & 15

VI Post 50-Hour Component Qualification Data (HS 1234C)

Room Temperature Ambient conditions and 100 F Fuel Temp. are to be maintained during this portion of the test. (Control may be plumbed into drip table if desired).

Run 1

VI 1A	Same as in	I 1A
VI 1B	" " "	I 1B
VI 1C	" " "	I 1C
VI 1D	" " "	I 1D
VI 1E	" " "	I 1E
VI 1F	" " "	I 1F
VI 1G	" " "	I 1G
VI 1H	" " "	I 1H
VI 1I	" " "	I 1I
VI 1J	" " "	I 1J
VI 1K	" " "	I 1K
VI 1L	" " "	I 1L
VI 1M	" " "	I 1M
VI 1N	" " "	I 1N
VI 1O	" " "	I 1O
VI 1P	" " "	I 1P
VI 1Q	" " "	I 1Q
VI 1R	" " "	I 1R
VI 1S	" " "	I 1S
VI 1T	" " "	I 1T
VI 1U	" " "	I 1U
VI 1V	" " "	I 1V

VI (Cont)

Run 2

VI 2A	Same as in	I 1A
VI 2B	" " "	I 1B
VI 2C	" " "	I 1C
VI 2D	" " "	I 1D
VI 2E	" " "	I 1E
VI 2H	" " "	I 1H
VI 2L	" " "	I 1L
VI 2M	" " "	I 1M
VI 2N	" " "	I 1N
VI 2Q	" " "	I 1Q
VI 2R	" " "	I 1R
VI 2S	" " "	I 1S
VI 2U	" " "	I 1U
VI 2V	" " "	I 1V

Run 3

VI 3A	" " "	I 1A
VI 3B	" " "	I 1B
VI 3C	" " "	I 1C
VI 3D	" " "	I 1D
VI 3E	" " "	I 1E
VI 3H	" " "	I 1H
VI 3L	" " "	I 1L
VI 3M	" " "	I 1M
VI 3N	" " "	I 1N
VI 3Q	" " "	I 1Q
VI 3R	" " "	I 1R
VI 3S	" " "	I 1S
VI 3U	" " "	I 1U
VI 3V	" " "	I 1V

VII Windmill Bypass Check & Dump Valve High Temperature Qualification Test

The Main Fuel Control, Exhaust Nozzle Control, Exhaust Nozzle Control Pressure Regulating Valve and ENC Pressure Drop Cont. are then to be removed from the oven. A separate test in accordance with schematic 20X30 & F-5339 are then to be run on the Windmill Bypass Check & Dump Valve. During this test the following readings are to be taken: Twf, Pf3, Tamb; Wfm & Wfc at each 20 minutes interval throughout the test. All log entries shall call out the time for this phase of the test.

Upon removal of the components from the oven post calibration checks to the applicable H.S. Specifications are to be run on the Exhaust Nozzle Control, ENC Pressure Regulating Valve, ENC Pressure Drop Cont., and "In-Flight" Trimmer.

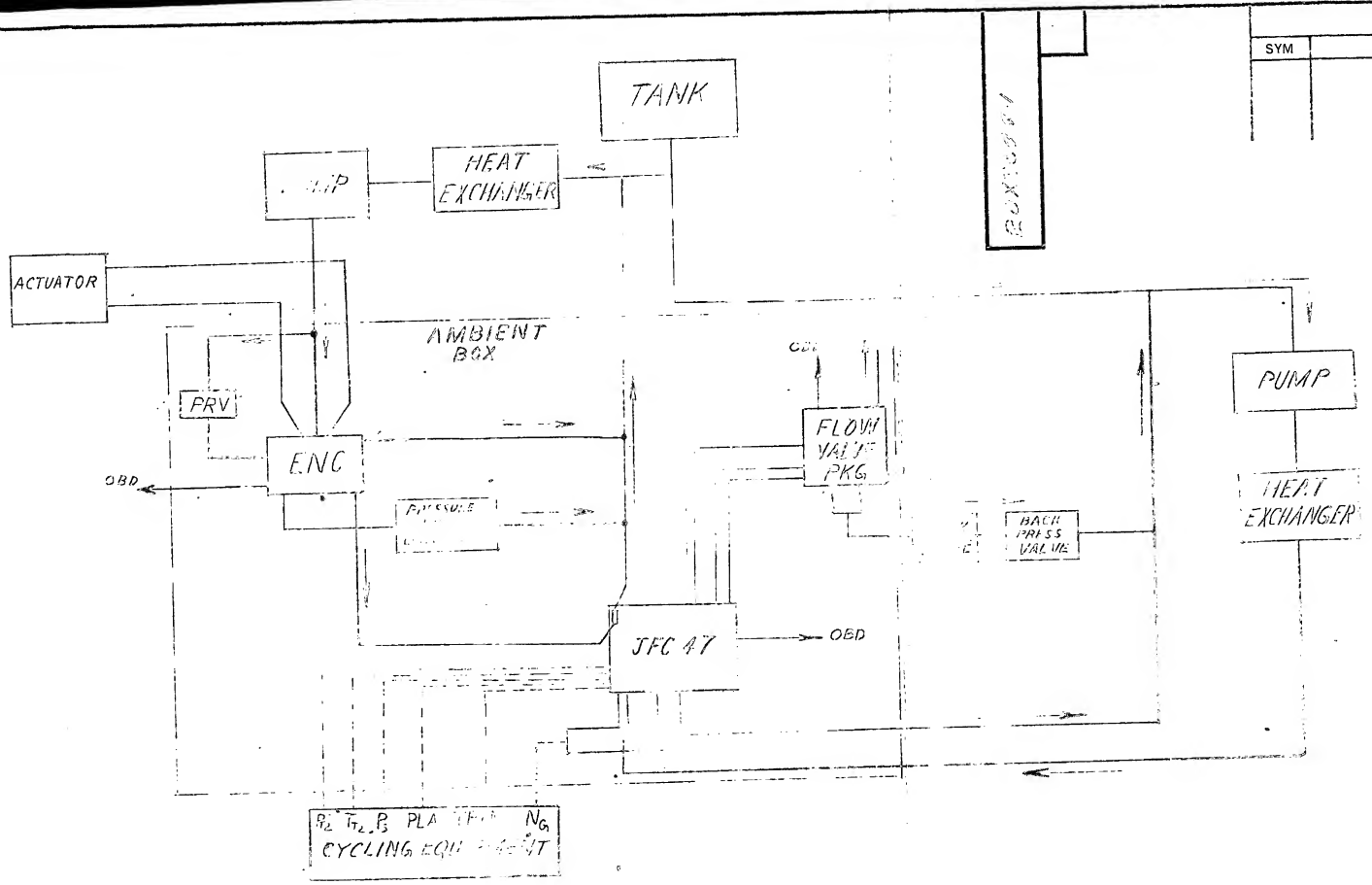
5. OBSERVE ALL SAFETY PRECAUTIONS ESTABLISHED FOR HIGH TEMPERATURE TEST ACTIVITIES. No deviations from this program are authorized without the permission of D.A. Prue (Office 8009, Home 693-4000) or M.D. Caswell (Office 8195, Home NO 8-2737) It will be the responsibility of the attending Engineer to monitor all requirements of HS 1584A & this plan of test.

All log sheets shall carry significant comments applicable to this plan, such as external leakage, overboard drain leakage, etc.

6. The results of this test shall be as defined by Paragraph 4.0 of HS 1548A.

Approved For Release 2009/07/08 : CIA-RDP67B00657R000100190001-9

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL



UNLESS OTHERWISE SPECIFIED:
DIMENSIONS SHOWN ARE AFTER PLATING & SIMILAR PROCESSES & BEFORE PAINTING.
BREAK EDGES .005-.025.
THREADS PER MIL-S-7742.
SURFACE CHARACTERISTICS: MIL-STD-10 PER HS1082.
△ MARK PART IDENTIFICATION: MIL-M-7911 PER HS333; OTHER SYMBOLS PER MIL-STD-8.

		RELEASE	DATE
MATERIAL		PROD. CODE	
HARDNESS		EXPERIMENTAL	
HEAT TREAT SPEC		PRELIM PROD.	
SURFACE COATING		PRODUCTION	
MFG SPEC		APPROVAL SIGNATURES	
MAKE FROM		DRAWN B. MERCIE 2-2-62	
		CHECKED	
		DRAFTING	
		MATERIALS	
		PROJECT	
		FACTORY	

FLIGHT SUITABILITY
BENCH TEST

NEXT ASSY	USED ON
APPLICATION	

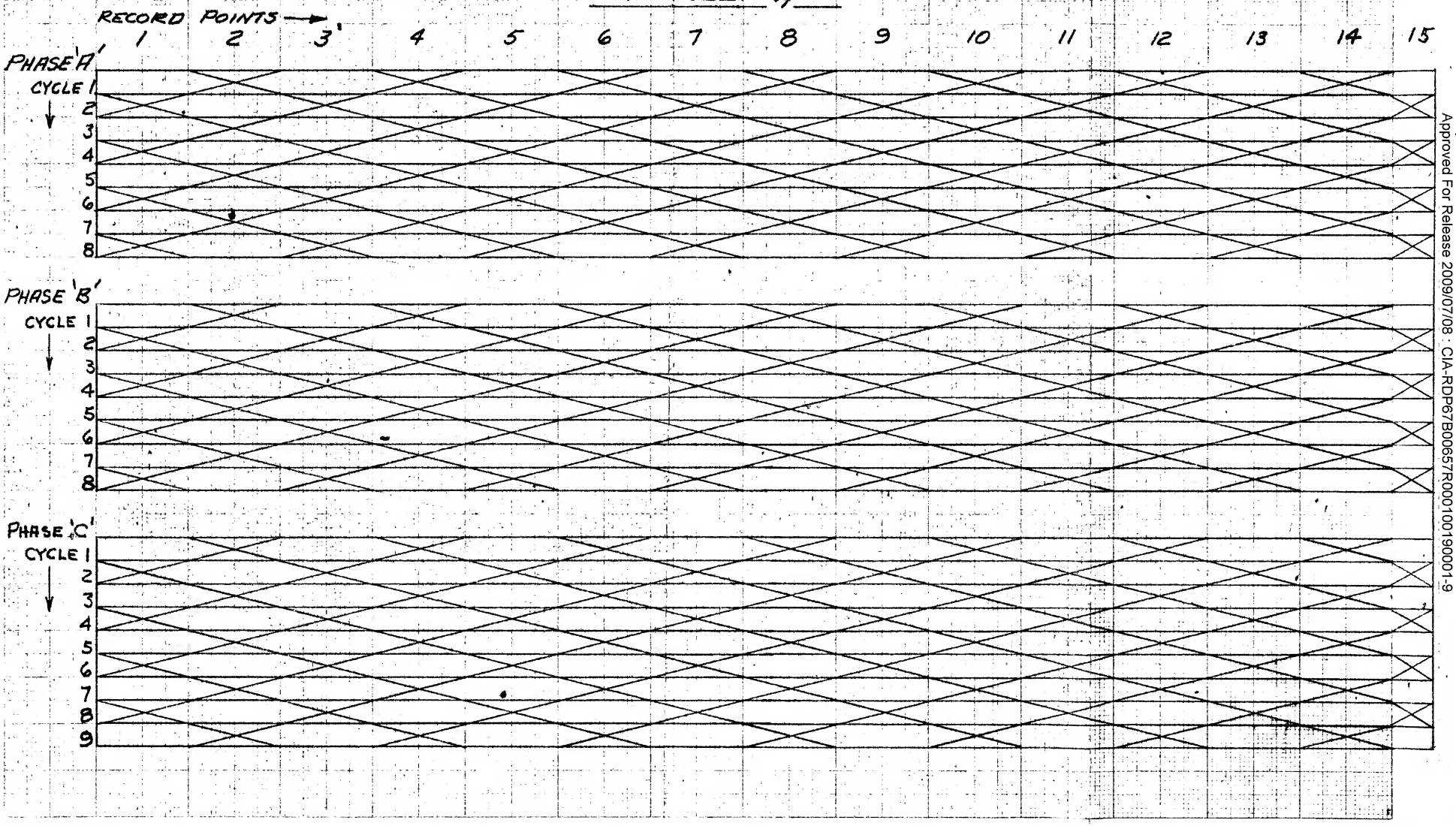
HAMILTON STANDARD
DIVISION OF UNITED AIRCRAFT CORPORATION
WINDSOR LOCKS, CONNECTICUT, U. S. A.

SCALE: | WT: LB | CODE 73030 | SHEET

PHOENIX N166 JOSEPH MERRITT & CO HS F-618.2D 6-60

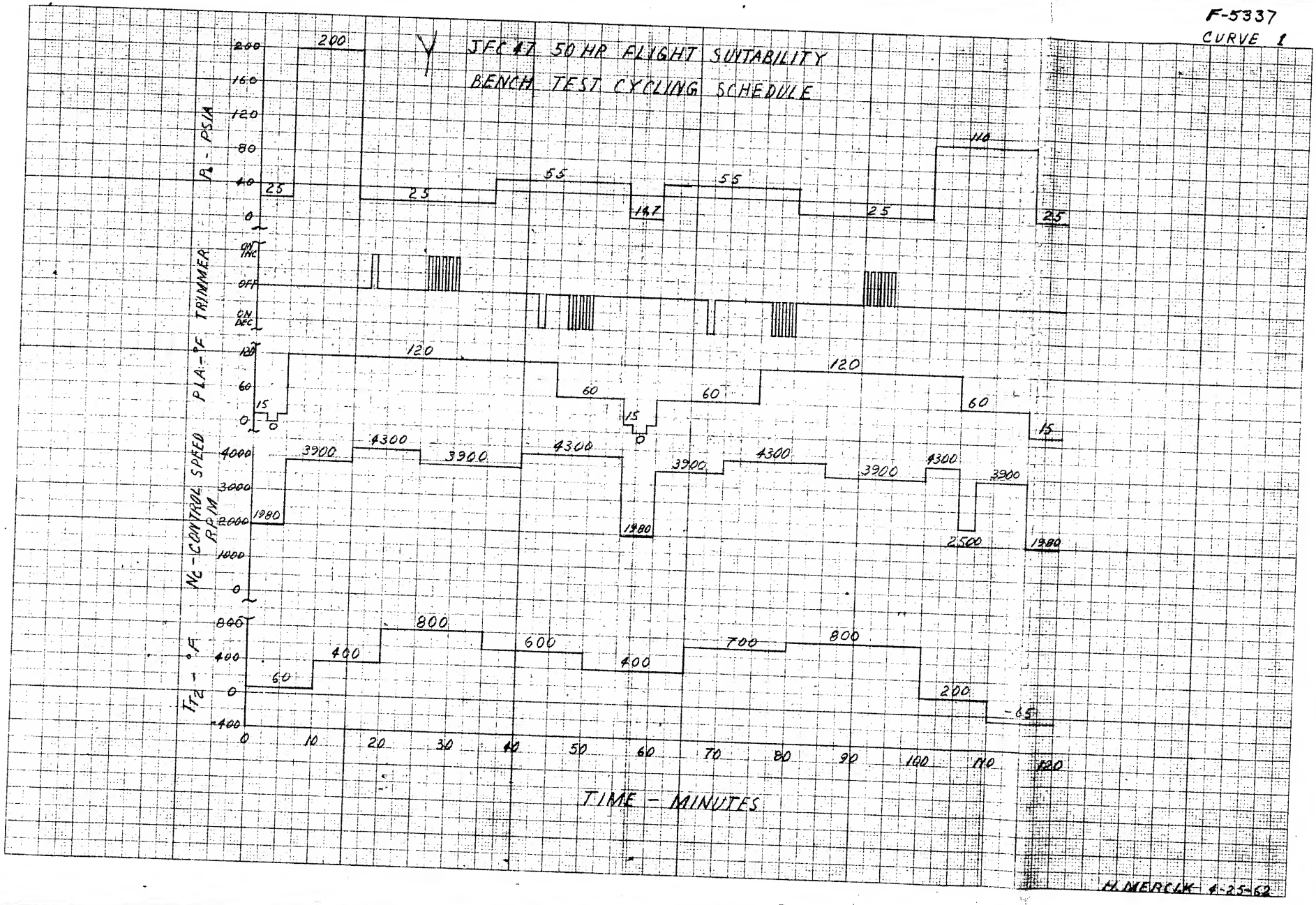
JFC-47 QUALIFICATION TEST SIMULATION SUMMARY SHEET

METERED W/F



Approved For Release 2009/07/08 : CIA-RDP67B00657R000100190001-9

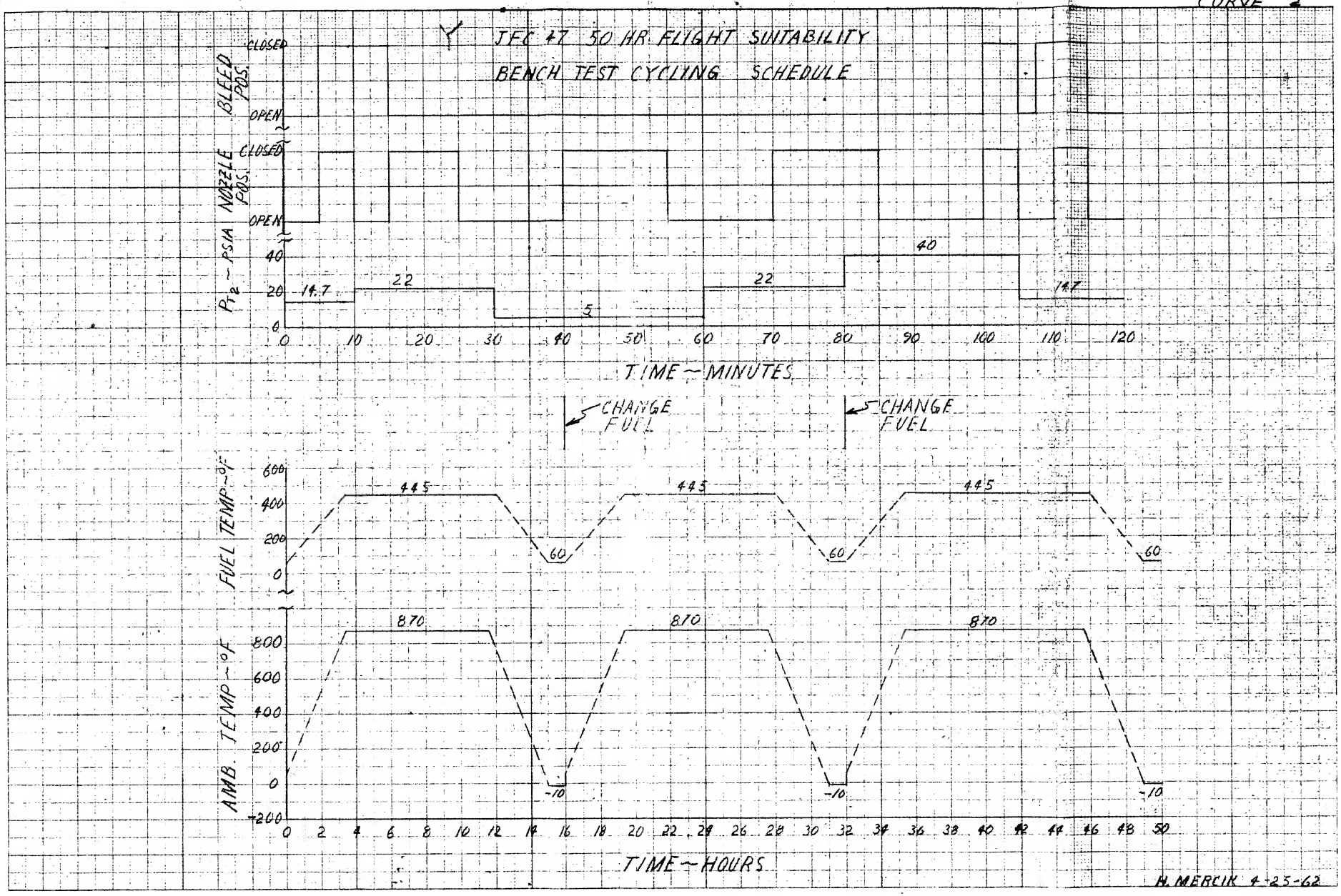
F-5337
CURVE 1



Approved For Release 2009/07/08 : CIA-RDP67B00657R000100190001-9

F-5338

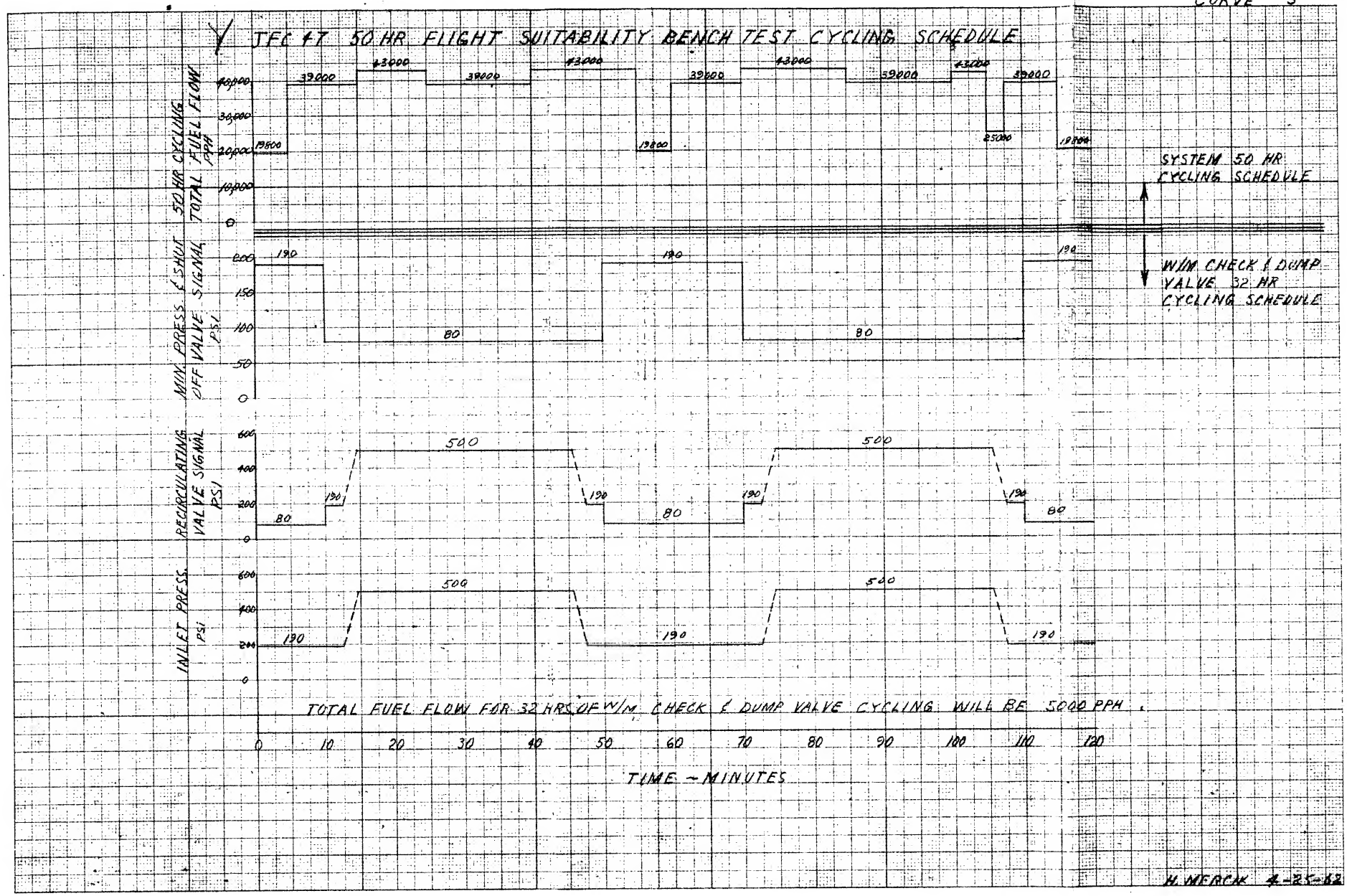
CURVE 2



Approved For Release 2009/07/08 : CIA-RDP67B00657R000100190001-9

F-5339
CURVE 3

JFC 4T 50 HR FLIGHT SUITABILITY BENCH TEST CYCLING SCHEDULE



H. WERCK 4-25-62

Approved For Release 2009/07/08 : CIA-RDP67B00657R000100190001-9

HSF-755D 4/61

HS 1539 A

CODE IDENT. NO. 73030

PAGE 1 OF 8

HAMILTON STANDARD
DIVISION OF UNITED AIRCRAFT CORPORATION
WINDSOR LOCKS, CONNECTICUT, U. S. A.

Alt. Ltr. "A"
5/21/62
?

SPECIFICATION NUMBER 1539A

TITLE 50 HOUR TEST OF JFC-51 MISSION - CYCLE ENDURANCE (FOR 50 HOUR ENGINE PRE-FLIGHT RATING TEST)

PREPARED BY	[redacted]	2/28/62 DATE	APPROVED BY	[redacted]	3-1-62 DATE
APPROVED BY	[redacted]	3/1/62 DATE	APPROVED BY		DATE
APPROVED BY	DESIGN	DATE	EXP. RELEASE		DATE
APPROVED BY	INSPECTION DEPT.	DATE	APPROVED BY	PRODUCTION DEPT.	DATE
APPROVED BY	MATERIALS ENGR.	DATE	PROD RELEASE		DATE
GOVERNMENT (WHEN REQ'D)					DATE

STAT

1.0 SCOPE

1.1 This specification defines a flight suitability test of the Hamilton Standard JFC-51 Afterburner Control Assembly.

1.2 A mission-cycle is defined as a unit of installed-control usage. In the mission-cycle, changes in environmental conditions: ambient and fuel temperature, Tamb and T_f, and in control operating condition: speed signal, SS; power lever angle, PLA; compressor discharge pressure, CDP; compressor inlet temperature, T_{t2}; compressor bleed position, CBA will be simulated. TRP is the temperature of the radiation plate from which the control is mounted in the ambient box.

1.3 A mission-cycle will require approximately 10 hours of running. The endurance test will be conducted for the completion of 5 mission-cycles or 50 hours, whichever is shorter.

2.0 DESCRIPTION OF COMPONENTS TESTED

2.1 The assembly used for the test will be made by retrofitting S/N 23683, a development control, to PL 20X35051. The schematic is the revised L-7208-2 (VEM JFC51.1.5152 compares this parts list with the "E", "X", and "Y" configurations and is a valid comparison except that control also has transfer system hardware per E.C. AZ71565).

2.2 Quality Control

2.2.1 S/N 23683 will be disassembled. The rebuild will be under development quality control requirements. The test will be conducted with HSD inspection cognizance. Particular handling of test-record documents is as follows:

2.2.1.1 Parts List

The parts list shall record the part number of all parts in the control throughout the test.

The original parts list can be reissued or given a special parts list number. In this case, all notations and historical data will be affixed to the new parts list.

2.2.1.2 Historical Log

Throughout the test, special cognizance of the quality of component hardware will be maintained on the historical log.

All work on the control shall require separate signatures by a builder, and an engineer. When possible, a separate entry will be made for each alteration. Each disassembly, any rework or replacement of a particular part, and each reassembly must be recorded.

2.2.1.3 Inspection Reports

Copies of the pre and post endurance inspection records shall be affixed to the parts list.

3.0 DESCRIPTION OF TEST

The evaluatory phases of this preliminary qualification test will be:

(a) Pre-endurance Inspection

(b) Calibration to HS Acceptance Specification 1509

(c) Endurance Test

(d) Calibration Check, to HS Acceptance Specification 1509

(e) Post-endurance Inspection

3.1 Pre-endurance Inspection

The pre-endurance records will be prepared jointly by Engineering and Inspection.

3.2 Calibration

Inspection witness of the calibration data will be required. Deviations to the H.S. Acceptance Specification will be acceptable, but must be recorded.

3.3 Endurance Test

3.3.1 The test will consist of mission-cycles in which control environment and operation are simulated. The mission-cycle is defined in 3.3.3 and graphically represented in Figure 1. Inspection witness of the data sheets and validity of temperature, pressure and leakage readings is required.

3.3.2 Test Fluid

3.3.2.1 The base fluid will be PWA 523.

3.3.2.2 The base fluid will not be contaminated.

3.3.3 Mission-Cycle

The mission-cycle will include three flight cycles each with an in-flight maneuver.

Appendix A is a plot of the data in Tables of paragraph 3.3.3.1.

3.3.3.1 Flight Cycle

The sequence from 15 min. flight cycle time to 190 min. flight cycle time shall be repeated three times in the 10 hour mission. Meanwhile, except for the first 120 minutes of the 1st flight cycle and last 25 minutes of the 3rd flight cycle of the mission, the ambient temperature will be 850°F. The rig fuel will be cooled from 325°F. to 105°F. at 190 min. flight cycle time of each flight cycle. The radiant panel temperature, except for the first 40 minutes of the first flight cycle and last 20 minutes of the 3rd flight cycle, will be 980°F.

FLIGHT CYCLE TIME Start	End	PHASE	CONTROL SETTINGS SS	PLA	CDP	T_{T2}	CBA	ENVIRONMENTAL SETTINGS $T_{amb.}$ 1st	$T_{amb.}$ 2nd/3rd	T_{rp} 1st	T_{rp} 2nd/3rd	Tf	Pumps
0	(15)	Dead Time	OFF	0	15	60	OPEN						
15	15		OFF	0	15	60	CLOSED	60°F.	850°F.		OFF	105°F.	OFF
15	(30)	Ground Idle	OFF	0	30	60	CLOSED	60°F	850°F		OFF	"	ON
20			OFF	0	30	60	CLOSED		850°F	300°F* MAX	ON		ON
	30		OFF	0	30	60	CLOSED	100°F	850°F	600°F	980°F	"	ON

*NOTE: First flight cycle, after 5 min. of ground idle T_{RP} to be 300°F. max., then heating is increased to reach 600°F. in 10 minutes.

30	(45)	Takeoff & Climb	ON[a]	120[a]	60[a]	*	CLOSED	*	850°F	*	980°F	105°F**	ON

*NOTE: T_{t2} and T_{amb} controls are set to heat; the temperatures to stabilize at 700°F in 15 minutes, and 850°F in 100 minutes respectively. T_{RP} is approximately 600°F at start of Take Off and Climb and is to reach 980°F (stabilized) in 15 minutes.

aNOTE: First SS, next PLA, then CDP.

**NOTE: Tf is increased in steps throughout flight cycle.

32	34		ON	120	140	"	CLOSED	"	"		"	"	ON
34	36		"	"	100	"	CLOSED	"	"		"	"	"

3.3.3.1 Flight Cycle (continued)

FLIGHT CYCLE TIME Start	End	PHASE	CONTROL SETTINGS SS	PLA	CDP	T_{T2}	CBA	ENVIRONMENTAL SETTINGS T_{amb} 1st	T_{amb} 2nd/3rd	T_{RP} 1st	T_{RP} 2nd/3rd	T_f	Pumps
36	38		ON	120	100	"	OPEN	"	850°F		980°F	105°F	ON
38	41		"	"	70	"	"	"	"		"	"	"
41	45		"	"	30	"	"	"	"	980°F	980°F	"	"
45	(165)	Flight											
45			ON	102°	30	700°F	OPEN					130°F	
60			"	"	"	"	"					156°F	
75	(90)	In-Flight Maneuver											
75	77		OFF	75°	30	700°F	OPEN					181°F	
77	79		"	120°	"	"	"					"	
79	80		"	50°	"	"	"					"	
80	82		ON	"	15	*	"					"	
		*BEGIN COOL T_{T2} to 450°F.											
82	84		"	"	"	450°F	"					"	
84	85		"	75°	"	"	"					"	
85	87		"	"	30	*	"					"	
		*BEGIN HEAT T_{T2} to 700°F.											
89	90		"	120°	"	700°F	"					"	
90	105		ON	120	30	700°F	OPEN					207°F	

3.3.3.1 Flight Cycle (continued)

FLIGHT CYCLE TIME Start	End	PHASE	CONTROL SETTINGS SS	PLA	CDP	T_{T2}	CBA	ENVIRONMENTAL SETTINGS T_{amb} 1st	T_{amb} 2nd/3rd	T_{RP} 1st	T_{RP} 2nd/3rd	T_f	Pumps
105	120		ON	120°	30	700°F	OPEN					232°F	
120	135		"	"	"	"	"					258°F	
135	145		"	"	"	"	"					283°F	
145	150		OFF									283°F	
150	155		"	"	"	"	"					308°F	
155	160		"	"	"	"	"					325°F	
160	165			"	"	"	"					325°F	
165	(190)	Land						1st/2nd	3rd	1st/2nd	3rd		
165	166		OFF	75°	30	*	OPEN	850°F	*OFF	980°F	980°	325°F	
	*NOTE: T_{T2} and T_{amb} controls to cold; CO_2 to ambient chamber.												
166	168		OFF	75°	70	"	OPEN	850°F	*	980°F	"	325°F	
168	170		"	"	100	"	"	"	"	"	"	325°F	
170	172		"	"	70[b]	"	CLOSED[b]	"	"	"	"	325°F	
	[b]NOTE: 1st CDP, then CBA.												
172	174		"	"	30	"	"	"	"	OFF	OFF	325°F	
174	175		"	50°	"	60°F	"	"	"	"	"	325°F	
175	185		"	0°	"	"	"	"	60°F	"	"	325°F	
185	190		"	"	"	"	"	"	"	"	"	**	

**NOTE: Begin to cool fuel for next flight cycle.

3.4 Calibration Check

A calibration check, including any portion of the HS Acceptance Data, may be made between mission-cycles. Inspection witness of the data is required. If the first mission-cycle has been completed, the final post-endurance calibration data (HS Acceptance Data) must be run before the control is removed from the rig.

3.5 Post Endurance Inspection

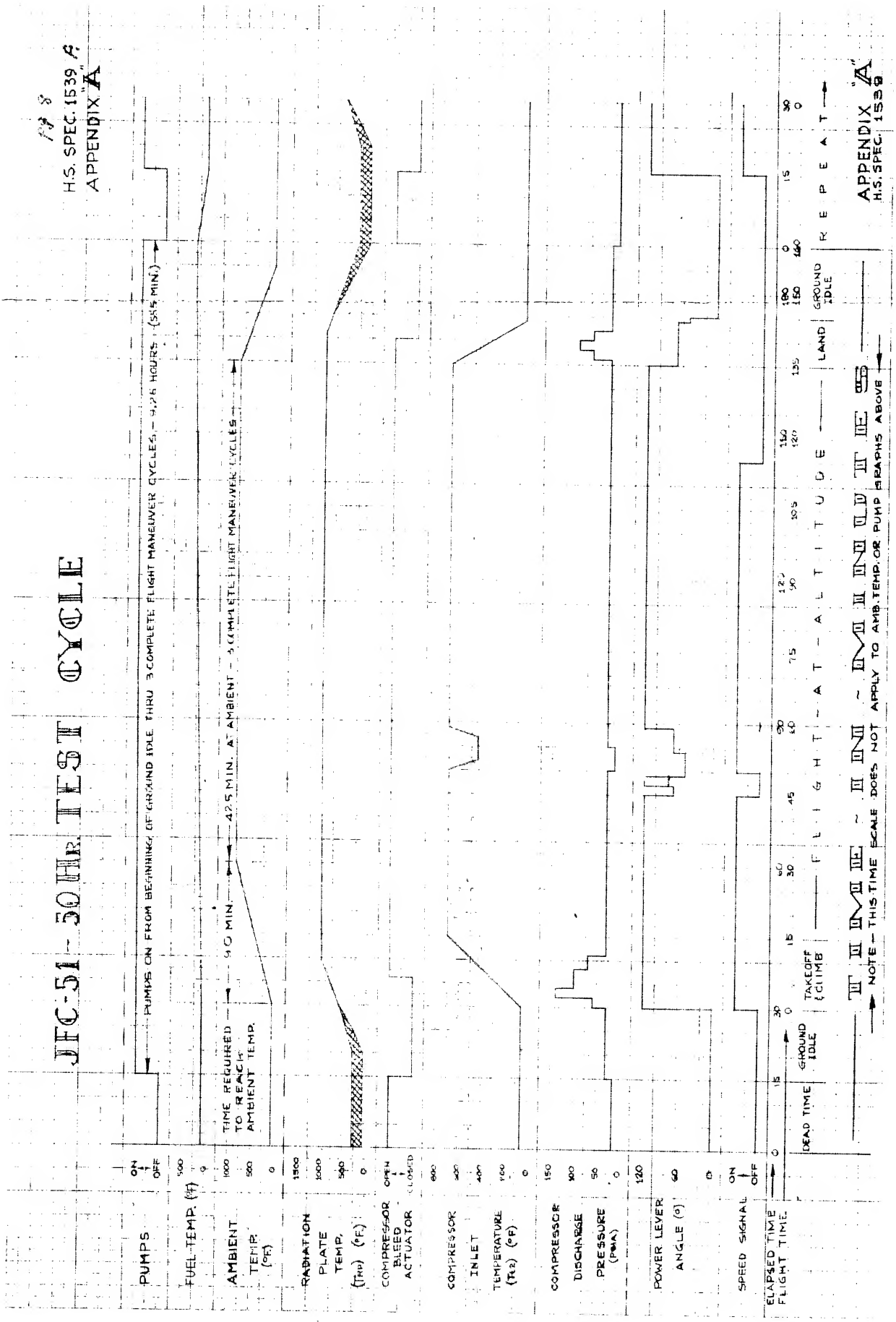
Inspection witness of post-endurance inspection shall be required.

4.0 REPORTS

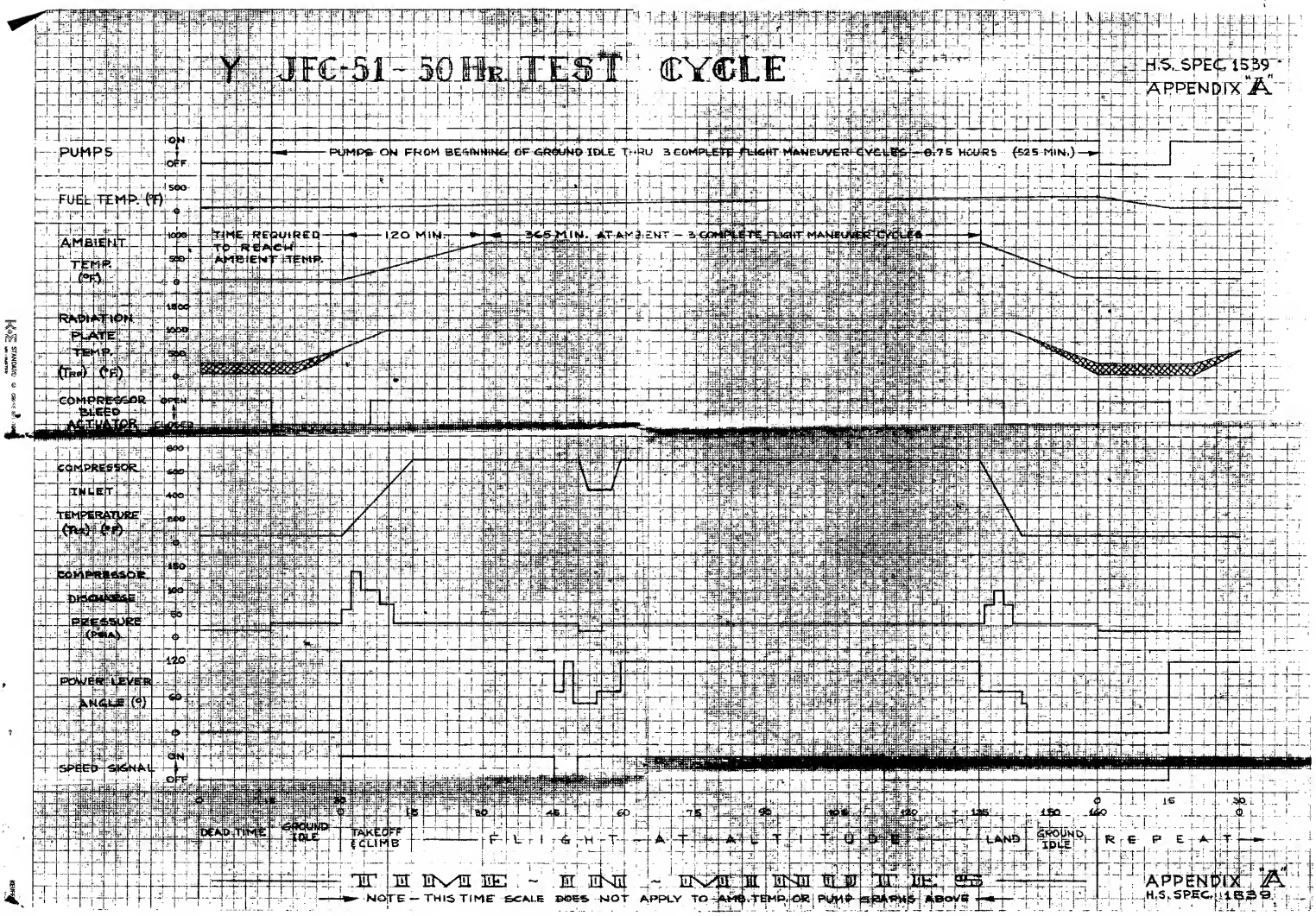
4.1 During the test, a Pratt & Whitney representative may witness any of the activity.

4.2 Upon completion of the last mission-cycle, a preliminary report will summarize the apparent control operation and effects of environment.

4.3 The final report, an HSIR, will summarize the test, and give an account of the data in each of the evaluatory stages of the test.



Pg 8
H.S. SPEC. 1539 A
APPENDIX "A"



HAMILTON STANDARD

TP-C5 TURBOPUMP PRE FLIGHT

RATING TEST PROGRAM

Written by: [redacted] STAT
Assistant Project Engineer

Approved by: [redacted] STAT
Project Engineer

February 16, 1962
Revised - March 30, 1962
" April 30, 1962

F-62

1.0 SCOPE

1.1 This Specification defines the pre-flight rating test to be conducted on a TP-C5 turbopump P/N 579100 in accordance with P&WA Purchase Specification No. J-55A.

1.2 Satisfactory completion of this test constitutes compliance with the requirements of Paragraph 5.2.3.4 of P&WA Purchase Specification No. J-55A.

2.0 CONFIGURATION TO BE TESTED

2.1 A TP-C5 model turbopump, P/N 579100, shall be used for the pre-flight rating test in accordance with this specification. The turbine housing will be shrouded to permit ducting of air from the turbine housing bleed holes to the turbine discharge duct.

3.0 QUALITY CONTROL

3.1 The turbopump shall incorporate parts controlled by HSD Inspection, with the exception of the turbine housing P/N 567462, which will be a development housing (Test Stores) suitably shrouded to permit ducting of air from the turbine housing bleed holes to the turbine discharge line. Assembly of the unit will be under HSD Inspection cognizance. The test shall be witnessed by HSD Inspection and P&WA Source Inspection. Any changes to the standard part number configuration shall be noted on the unit parts list and fully described by drawings attached to the parts list.

3.2 The unit parts list shall record part number, change letter, and quality control symbol of all parts used in the turbopump. Any changes or deviations from standard configuration shall be noted on the parts list and fully defined by attached drawings, if necessary.

3.3 A historical log shall be maintained and kept with the unit at all times. The historical log shall include the following information:

1. Date of start of assembly.
2. Date of completion of assembly.
3. Date of start of test.
4. Date of completion of test.
5. Records of all disassembly or rework effort.

Entries in the historical log shall be witnessed by HSD Inspection.

4.0 DESCRIPTION OF TEST

4.1 The unit shall undergo an acceptance test in accordance with HS 1289E prior to the start of the pre-flight rating test.

4.2 Upon satisfactory completion of (4.1), the unit shall be subjected to a high temperature endurance test in accordance with the requirements of Table I.

4.3 After completion of the pre-flight rating test in accordance with (4.2), the unit shall be subjected to an acceptance test in accordance with HS 1289E.

4.4 The fuel used shall be PWA 523; the lubricant shall be five ring polyphenyl ether, supplied by the Monsanto Chemical Company and designated OS 149.

5.0 REPORTS

5.1 An EM shall be forwarded to P & WA within one week after completion of the test summarizing the results of the test.

5.2 An HSIR will be forwarded to P & WA within six weeks after completion of the test reporting results of the test and including photographs of critical detail parts.

6.0 APPROVALS

6.1 The cognizant P & WA Assistant Project Engineer shall forward approval of this specification by EM, prior to the start of the test.

6.2 Approval of the test as demonstrating of compliance with the pre-flight rating testing requirements of P & WA Purchase Specification J-55 shall be forwarded by the cognizant P & WA Assistant Project Engineer in the form of an EM. This approval may be based on the test summary EM in accordance with Paragraph 5.1, actual witness of the disassembly after completion of the test, or the HSIR in accordance with Paragraph 5.2.

TABLE I

TEST SCHEDULE - TP-C5

8.5 HOUR AND 17 HOUR DURATION

Cond.	Minutes Based On 8.5 - Hr. Cycle	Minutes Based On 17 - Hr. Cycle	Spec. Oil Inlet Temp. °F	Proposed Oil Inlet Temp. °F	Ambient Temp. °F	Turbine Inlet Temp. °F	Fuel Inlet Temp. °F	Spec. Ambient Pressure psia	Proposed Ambient Pressure psia	Pump ΔP Min. psi	Fuel Flow #/hr.
*A	7.5	15	160	200 Min.	480	900	90	14.7	14.7	655	43,000
B	7.5	15	230	230 Min.	800	1235	115	.42	1.75 Max.	535	32,000
C	120	240	345	345 Min.	815	1250	220	.37	1.75 Max.	415	20,500
D	120	240	440	440 Min.	840	1265 Min.	300 Min.	.30	1.75 Max.	395	16,000
E	30	60	540	540 Min.	870 Min.	1265 Min.	300 Min.	4.3	4.3	250	3,000
F	60	120	480	480 Max.	**10 Max.	420 Max.	300 Max.	4.5	4.5	250	3,000
G	30	60	260	260 Min.	810	1240	130	.45	1.75 Max.	585	18,500
H	45	90	340	340 Min.	835	1265 Min.	210	.30	1.75 Max.	565	17,500
I	60	120	440	440 Min.	870 Min.	1265 Min.	280	.25	1.75 Max.	505	13,000
J	15	30	230	230 Min.	800	1230	140	.55	1.75 Max.	565	20,500
K	15	30	540	540 Min.	800	1265 Min.	300 Min.	14.7	14.7	250	3,000

Approved For Release 2009/07/08 : CIA-RDP67B00657R000100190001-9

Oil ΔP (Max.): 45 psi
Oil Flow (Min.): .28 gpm
Fuel Inlet Pressure: 30 psig

NOTES:
1. The 17 hour schedule is to be run 3 times in succession to constitute a 51 hour qualification test.
2. Time involved in transient changes is to be charged to the lower temperature condition. When running conditions E and I, ambient temperature may start to be decreased for the next condition once 870°F has been obtained.
3. All temperatures to be ±25°F unless otherwise specified.
4. Ambient pressures to be ±1 psi unless otherwise specified.
5. Fuel flows to be within ±1000 pph of specified fuel flow.

*Due to equipment limitations it shall be permissible to run this condition three (3) times consecutively.
**This temperature is to be held until the oil outlet temperature is stabilized. Temperature may be increased toward the next condition after stabilization is reached.

Approved For Release 2009/07/08 : CIA-RDP67B00657R000100190001-9

HSF-755D 4/61

HS 1583

CODE IDENT. NO. 73030

HAMILTON STANDARD
DIVISION OF UNITED AIRCRAFT CORPORATION
WINDSOR LOCKS, CONNECTICUT, U. S. A.

SPECIFICATION NUMBER 1583

TITLE CHEMICAL IGNITION SYSTEM, CIS-1, QUALIFICATION TEST OF, 50 HOUR MISSION CYCLE

PREPARED BY [redacted]	DATE 2/1/62	APPROVED BY [redacted]	DATE 2/6/62
APPROVED BY [redacted]	DATE 2/6/62	APPROVED BY	DATE
APPROVED BY DESIGN	DATE	EXP. RELEASE	DATE
APPROVED BY INSPECTION DEPT.	DATE	APPROVED BY PRODUCTION DEPT.	DATE
APPROVED BY MATERIALS ENGR.	DATE	PROD RELEASE	DATE
GOVERNMENT (WHEN REQ'D)			DATE

STAT

STAT

1.0 SCOPE

This specification defines a 50 hour component bench qualification test of the Hamilton Standard Chemical Ignition System, CIS-1. This test is based on the mission outlined in Curve No. F 13403 supplied by Pratt & Whitney Aircraft.

2.0 DESCRIPTION OF COMPONENTS TESTED

2.1 The unit to be tested will be a new production control, P/N 574242, as delivered from Hamilton Standard Production Department without modifications.

2.2 Quality Control

2.2.1 General Inspection

Prior to the test, all parts and assemblies shall be inspected to determine if they conform to the Hamilton Standard parts list and all requirements of the contract and specifications under which the control was built. At no time during the test shall any part of the igniter be removed, disassembled, or adjusted without prior notification to the cognizant Pratt & Whitney Project Engineer. Such notification shall not constitute approval of removal, disassembly, or adjustment.

2.2.2 Acceptance Test - HS 1388

Prior to the qualification test, the control must satisfactorily pass this acceptance test. The audit section of this test shall be performed with the cognizance of a Pratt & Whitney inspector.

2.2.3 Handling of Records

All work on the control shall require an entry on the historical log with signatures by the builder and an inspector.

Copies of all inspection reports, acceptance test logs, and all other test logs shall be attached to the historical log.

The foremen of the assembly and test areas are responsible that these records travel with the control and are used by their personnel.

3.0 DESCRIPTION OF TEST

The test shall consist of seven endurance cycles (at least 50 hours total) performed per paragraph 3.1. These are based on the mission outlined in Curve No. F13403 supplied by Pratt & Whitney.

3.1 Test Schedule

Table I describes the operating and environmental conditions to be accomplished during each endurance cycle.

3.1.1 Any deviation from these limits, other than time (refer to Paragraph 3.2), shall be submitted to Hamilton Standard and Pratt & Whitney Engineering for arbitration.

3.2 Test Time

3.2.1 The time periods shown in Table I for warmup and cooling are estimates. These temperature changes should be accomplished as rapidly as the test equipment will permit.

3.2.2 Time required in excess of that shown in Table I for any phase of the cycle shall be considered dead-time and shall not be counted as endurance time.

TABLE I - ENDURANCE CYCLE OF 50 HOUR QUALIFICATION TEST OF CIS-J

Test Time Hrs.	Test Time Min.	Unit Action	T-3 Amb. Temp. °F.	T-8 Cooling Fuel Temp. °F.	G-7 P3 Psig	ATM P5 Psig	G-5 Main Manifold Psig	G-4 A/B Manifold Psig	G-9 Dump In Psig	G-3 Dump Out Psig	G-9 Fuel Cooling In Psig	G-3 Fuel Cooling Out Psig	T-15 T-14 Dump In Temp. °F.
0	0		70±15	80±20	25±2	25±2	0	0	85±25	15±15	85±25	15±15	80±20
0	02	Fire Main	"	"	"	"	160 ± 10	"	"	"	"	"	"
0	05	Fire A/B	"	"	"	"	"	160 ± 10	"	"	"	"	"
1	00	-	870±15	325±20	"	"	500 ± 25	500 ± 25	"	"	"	"	325±20
2	15	-	"	"	"	"	"	"	"	"	"	"	"
2	30	-	10 ± 50 °F	90 ± 20	"	"	"	0	"	"	"	"	90 ± 20
3	00	Fire A/B	10 ± 50 °F	90 ± 20	"	"	500 ± 25	100 ± 10	"	"	"	"	90 ± 20
4	00	-	870 ± 15 °F	325 ± 20	"	"	500 ± 25	500 ± 25	"	"	"	"	325 ± 20
5	15	-	870 ± 15	325 ± 20	"	"	"	"	"	"	"	"	325 ± 20
5	30	-	10 ± 50	90 ± 20	"	"	" 100±10	0	"	"	"	"	90 ± 20
6	00	Fire A/B	10 ± 50	90 ± 20	"	"	" 100±10	100 ± 10	"	"	"	"	"
7	00	-	870 ± 15	325 ± 20	"	"	"	500 ± 25	"	"	"	"	325 ± 20
8	15	-	"	"	"	"	"	"	"	"	"	"	"
8	30	Dump	100 ± 50	250 ± 50			160 ± 10	0	*3000 ± 200	"	"	"	200 ±200

* 3000 ± 200 psi initial pressure may bleed to 85 psi ± 25 psi.

3.3 Test Logs

Test logs shall be maintained of all conditions specified in the preceding table. Any apparent malfunction shall be recorded.

3.4 Test Fluids

3.4.1 Engine fuel - P&WA 523

3.4.2 Pyrophoric Fluid - Triethylborane

3.4.3 Propellant - Nitrogen

3.5 Filling of Unit

Prior to each mission cycle, the control shall be filled with the amount of pyrophoric fluid required for twelve normal shots (48 cc ± 5 cc each). The unit shall then be pressurized to 652 psi ± 5 psi with nitrogen and the assembly completed per the 574242 configuration.

4.0 Post Endurance Inspection

4.1 Upon completion of the endurance cycling, the pyrophoric fluid valves will be tested per Paragraph 4.2 (b). This may be done by the laboratory personnel.

4.2 Upon completion of Paragraph 4.1, the unit may be flushed with P&W 523 or MIL-F-7024A fluid to remove all pyrophoric fluid.

4.3 Acceptance Test - HS 1388

After flushing the control must comply with HS 1388 Acceptance Test Specification with the following permissible deviations:

(a) Propellant leakage past the filler valve assembly will not exceed 50 bubbles per minute.

(b) Pyrophoric fluid valves will be acceptable if no evidence of pyrophoric fluid leakage (flame or smoke) is observed at the discharge ports after 15 minutes with the tank pressure at 3000 psi. (Refer to Paragraph 4.1).

(c) Internal dynamic seal leakage, except for pyrophoric fluid valves, will be allowed to increase by a factor of 100% over the acceptance test limits.

(d) The test fluid may be either P&W 523 or MIL-F-7024A Type II.

The audit section of this test shall be performed with the cognizance of a P&W Inspector.

4.4 Detail Parts Inspection

4.4.1 After completion of Paragraph 4.2, the control shall be disassembled. All parts shall be inspected. All signs of wear or deterioration shall be recorded.

4.4.2 Any indication of imminent malfunction will be submitted to Hamilton Standard and Pratt & Whitney Engineering for arbitration.

4.4.3 Upon mutual agreement by Hamilton Standard and Pratt & Whitney Engineering that the control could have continued to operate satisfactorily, the qualification test will be considered to be successfully completed.

5.0 REPORT

The final report of this qualification test shall be attested to by an appropriate PWA representative and shall include at least the items mentioned in Section 3.1.1 of MIL-E-5009B. Twelve copies of this report shall be supplied to the Engineering Department of Pratt & Whitney Aircraft, Florida Research and Development Center.